SDG 428907

428907

CAPE ENVIRONMENTAL MANAGEMENT INC
404 E. Ramsey, Suite 206
SAN ANTONIO, TX 78216

CHAIN-OF-CUSTODY RECORD

(If no box checked use routine)
☒ Routine
☐ Urgent
☐ EMERGENCY

Chain of Custody Number T030GL04	Project Manager (Print) Mike Bowlby	CAPE Project Manager (Print) Krishna Nalavala	Laboratory ~~SGS Accutest~~ GEL Laboratories LLC
Contractor CAPE	Project Name Corrective Action at Fort Bliss	Sampler's Name (Print) Seth Moorehead	Laboratory Contract Number
ERPIMS Yes ___ No X	Site(s) Oro Grande Landfill	(b) (6) [redacted]	ANALYSES REQUESTED

Sample Number LNNNNNNNN	Station Number LLNNNLLNNN	Sample Type (E-21) See VVL	Sample Matrix (E-17) See VVL	Sample Method (E-23) See VVL	Begin Depth NN.N	End Depth NN.N	Date dd mmm yy NN LLL NN	Time 24 HR NNNN	Field Lot Number NNNL	Number of Contain. N	Sr-89	Sr-90	Gross A/B						See Notes
T030GL-WC04		N-1	SO	SS	7.-5	9.-0	07/25/17	0750	000A	1	X	X	X						
T030GL-WC12		N-1	SO	SS	10.-0	13.-0	07/25/17	1240	000A	1	X	X	X						
T030GL-WC13		N-1	SO	SS	6.-0	10.-5	07/25/17	1330	000A	1	X	X	X						
					--	--													
					--	--													
					--	--													
					--	--													
					--	--													

(b) (6) [redacted]	Date/Time 07/25/17 1830	Rece(b) (6) [redacted]	Date/Time 7/26/17 9:45	PROTOCOL (circle one)
				HAZWRAP (EPA) OTHER
	Date/Time	Received By (Signature)	Date/Time	QC LEVEL (circle one)
				1 2 3 (4) 5
				FOR LABORATORY USE ONLY
				CONDITIONS OF SAMPLES UPON RECEIPT
Relinquished By (Signature)	Date/Time	Received By (Signature)	Date/Time	CHAIN OF CUSTODY Y N ICE
				REQUEST FOR ANAL Y N TEMP
				CUSTODY SEAL Y N pH
Sample Shipped Via (circle one): UPS (FED-EX) AIRBORNE BUS HAND OTHER		Waybill Number:		SAMPLE CONDITION

REMARKS (Notes):
1)
2)
Run the MATRIX SPIKE / MATRIX SPIKE DUPLICATE on:

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: CAPE	SDG/AR/COC/Work Order: 428907
Received By: ZKW	Date Received: 7/26/17
Carrier and Tracking Number	Circle Applicable: FedEx Express FedEx Ground UPS Field Services Courier Other 8113 0695 2269

Suspected Hazard Information	Yes	No	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
Shipped as a DOT Hazardous?		✓	Hazard Class Shipped: UN#:
COC/Samples marked or classified as radioactive?		✓	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): 0 CPM mR/Hr Classified as: Rad 1 Rad 2 Rad 3
Is package, COC, and/or Samples marked HAZ?		✓	If yes, select Hazards below, and contact the GEL Safety Group. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other:

	Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	✓			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Chain of custody documents included with shipment?	✓			
3	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*		✓		Preservation Method: Wet Ice Ice Packs Dry ice None Other: *all temperatures are recorded in Celsius TEMP: 21°C
4	Daily check performed and passed on IR temperature gun?	✓			**Temperature Device Serial #:** IR3-16 Secondary Temperature Device Serial # (If Applicable):
5	Sample containers intact and sealed?	✓			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6	Samples requiring chemical preservation at proper pH?		✓		Sample ID's and Containers Affected: If Preservation added, Lot#:
7	Do any samples require Volatile Analysis?			✓	If Yes, Are Encores or Soil Kits present? Yes___ No___ (If yes, take to VOA Freezer) Do VOA vials contain acid preservation? Yes___ No___ N/A___ (If unknown, select No) VOA vials free of headspace? Yes___ No___ N/A___ Sample ID's and containers affected:
8	Samples received within holding time?	✓			ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	✓			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	✓			Sample ID's affected:
11	Number of containers received match number indicated on COC?	✓			Sample ID's affected:
12	Are sample containers identifiable as GEL provided?	✓			
13	COC form is properly signed in relinquished/received sections?	✓			

Comments (Use Continuation Form if needed):

PM (or PMA) review: Initials [redacted] Date 7/31/17 Page 1 of 1

GL-CHL-SR-001 Rev 5

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : CAPE Environmental Management
Address : Inc.
500 Pinnacle Court, Suite 100

Atlanta, Georgia 30071

Report Date: August 17, 2017

Contact: (b) (6)
Project: Oro Grande

Client Sample ID: T030GL-WC04
Sample ID: 428907001
Matrix: Soil
Collect Date: 25-JUL-17
Receive Date: 26-JUL-17
Collector: Client
Moisture: 3.37%

Project: CAPE00117
Client ID: CAPE005

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
GFPC Gross A/B, Solid "Dry Weight Corrected"														
Alpha		10.5	+/-2.65	2.25	+/-3.32	4.00	pCi/g			AXH4	08/12/17	0936	1688239	1
Beta		21.3	+/-2.71	3.10	+/-3.88	10.0	pCi/g							
GFPC,Sr89&Sr90, Solid "Dry Weight Corrected"														
Strontium-89	U	-0.0582	+/-0.976	1.83	+/-1.24	2.00	pCi/g			KSD1	08/14/17	1440	1688228	2
Strontium-90	U	0.239	+/-0.657	1.77	+/-1.00	2.00	pCi/g							

10.5
21.3
-0.0582 U
0.239 U

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	LYT1	08/03/17	0634	1688078

The following Analytical Methods were performed

Method	Description
1	EPA 900.0/SW846 9310/SM 7110B Modified
2	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery %	Acceptable Limits
Strontium Carrier	GFPC,Sr89&Sr90, Solid "Dry Weight Corrected"	1688228	85.2	(30%-110%)
Yttrium Carrier	GFPC,Sr89&Sr90, Solid "Dry Weight Corrected"	1688228	91.1	(30%-110%)

(b) (6)

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : CAPE Environmental Management Inc.
Address : 500 Pinnacle Court, Suite 100
Atlanta, Georgia 30071

Report Date: August 17, 2017

Contact: (b) (6)
Project: Oro Grande

Client Sample ID: T030GL-WC12
Sample ID: 428907002
Matrix: Soil
Collect Date: 25-JUL-17
Receive Date: 26-JUL-17
Collector: Client
Moisture: 2.4%

Project: CAPE00117
Client ID: CAPE005

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
GFPC Gross A/B, Solid "Dry Weight Corrected"														
Alpha	12.7	12.7	+/-2.53	3.27	+/-3.56	4.00	pCi/g			AXH4	08/14/17	1826	1688239	1
Beta	24.1	24.1	+/-1.74	1.79	+/-4.00	10.0	pCi/g							
GFPC,Sr89&Sr90, Solid "Dry Weight Corrected"														
Strontium-89	-1.32 U	U	-1.32	+/-0.351	1.28	+/-0.643	2.00	pCi/g		KSD1	08/14/17	1125	1688228	2
Strontium-90	-0.626 U	U	-0.626	+/-0.447	1.52	+/-0.656	2.00	pCi/g						

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	LYT1	08/03/17	0634	1688078

The following Analytical Methods were performed

Method	Description
1	EPA 900.0/SW846 9310/SM 7110B Modified
2	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Strontium Carrier	GFPC,Sr89&Sr90, Solid "Dry Weight Corrected"	1688228	85.2	(30%-110%)
Yttrium Carrier	GFPC,Sr89&Sr90, Solid "Dry Weight Corrected"	1688228	92.9	(30%-110%)

(b) (6)

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : CAPE Environmental Management Inc.
Address : 500 Pinnacle Court, Suite 100

Atlanta, Georgia 30071

Report Date: August 17, 2017

Contact: (b) (6)
Project: Oro Grande

Client Sample ID: T030GL-WC13
Sample ID: 428907003
Matrix: Soil
Collect Date: 25-JUL-17
Receive Date: 26-JUL-17
Collector: Client
Moisture: 3.65%

Project: CAPE00117
Client ID: CAPE005

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
GFPC Gross A/B, Solid "Dry Weight Corrected"														
Alpha		16.4	+/-3.62	3.49	+/-4.88	4.00	pCi/g			AXH4	08/12/17	0936	1688239	1
Beta		22.1	+/-2.57	2.84	+/-4.05	10.0	pCi/g							
GFPC,Sr89&Sr90, Solid "Dry Weight Corrected"														
Strontium-89	-0.873 U	U	-0.873	+/-0.259	1.09	+/-0.851	2.00	pCi/g		KSD1	08/14/17	1125	1688228	2
Strontium-90	-0.655 U	U	-0.655	+/-0.598	1.84	+/-0.878	2.00	pCi/g						

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	LYT1	08/03/17	0634	1688078

The following Analytical Methods were performed

Method	Description
1	EPA 900.0/SW846 9310/SM 7110B Modified
2	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified

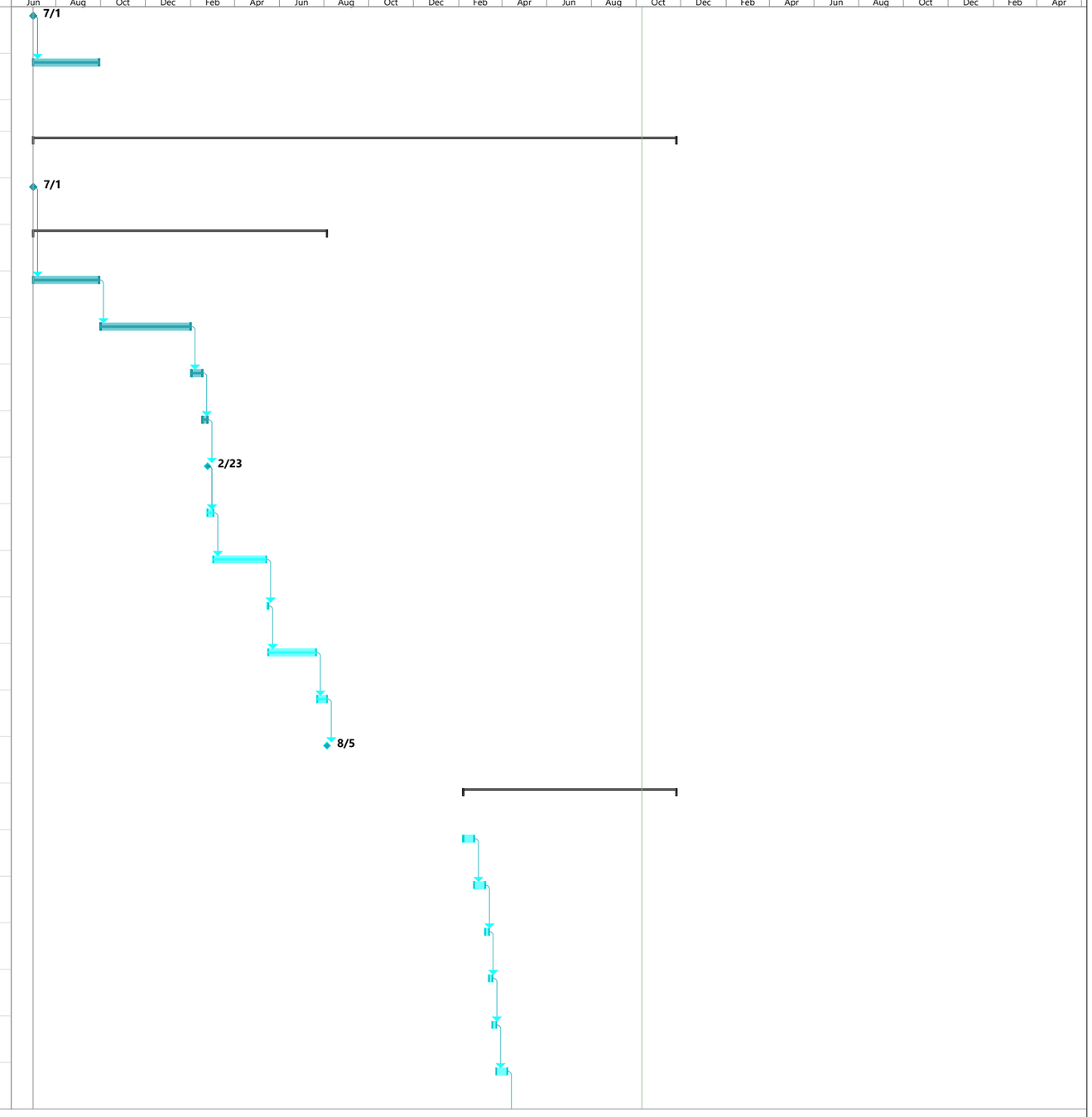
Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Strontium Carrier	GFPC,Sr89&Sr90, Solid "Dry Weight Corrected"	1688228	89	(30%-110%)
Yttrium Carrier	GFPC,Sr89&Sr90, Solid "Dry Weight Corrected"	1688228	102	(30%-110%)

(b) (6)

APPENDIX F

PROJECT SCHEDULE

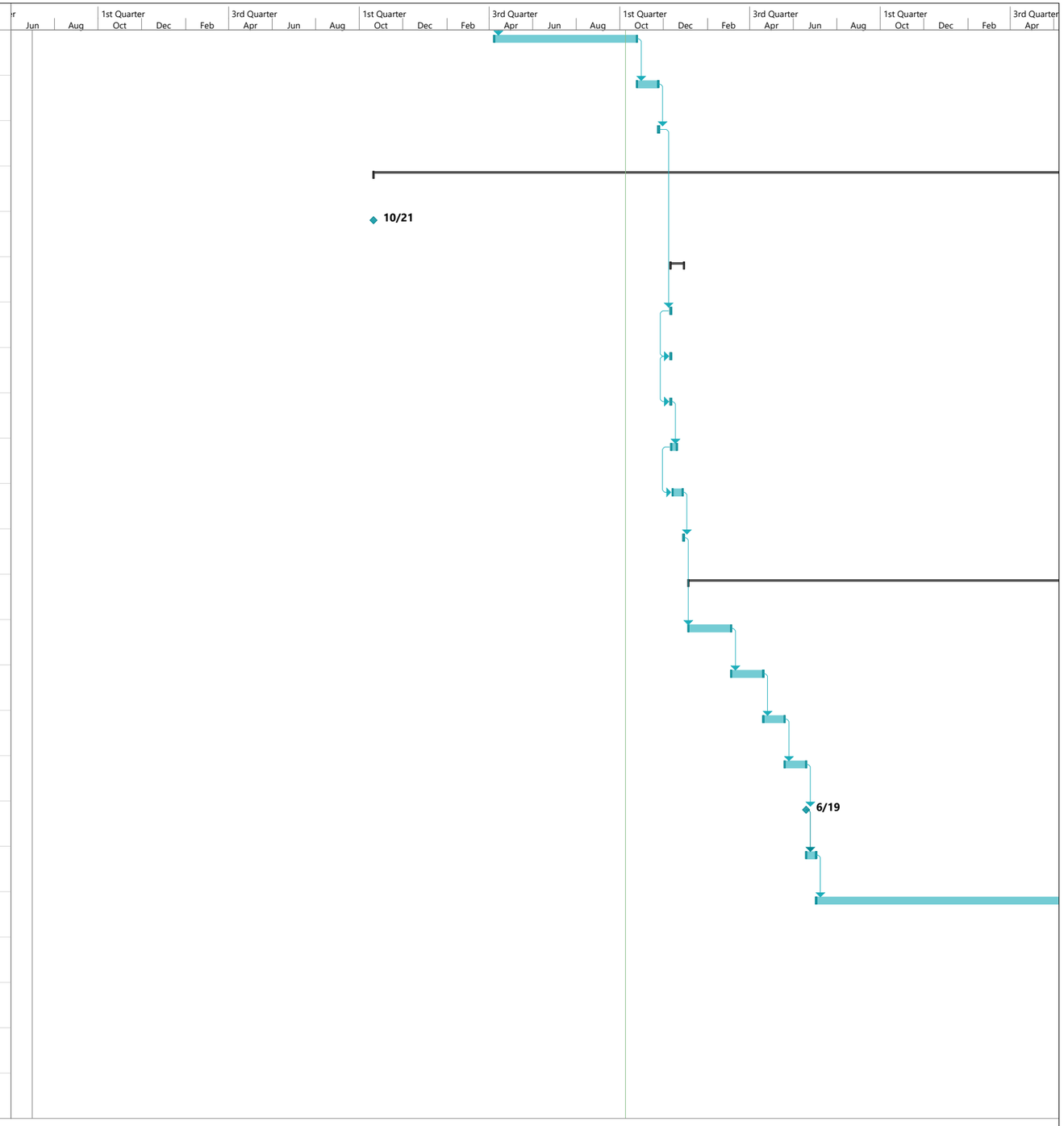
ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		Contract Award	0 days	Wed 7/1/15	Wed 7/1/15	
2		OPSEC / iWatch / and Other Security Requirements	90 days	Wed 7/1/15	Mon 9/28/15	1
3		POP Completion Date	0 days	Tue 5/5/20	Tue 5/5/20	
4		**0010_Complete a CA Work Plan at Oro Grande Landfill - POP 24 months**	**878 days**	**Wed 7/1/15**	**Fri 11/24/17**	
5		NTP for CLIN 0010	0 days	Wed 7/1/15	Wed 7/1/15	
6		**CA Work Plan**	**401 days**	**Wed 7/1/15**	**Fri 8/5/16**	
7		Prepare and Submit Draft	91 days	Wed 7/1/15	Mon 9/28/15	5
8		Army Review of Draft	124 days	Thu 10/1/15	Sun 1/31/16	7
9		Address Comments and Prepare Draft Final	15 days	Tue 2/2/16	Tue 2/16/16	8
10		Army Review of Draft Final	7 days	Wed 2/17/16	Tue 2/23/16	9
11		Army Approval of Draft Final CA Work Plan	0 days	Tue 2/23/16	Tue 2/23/16	10
12		Prepare Final and Submit to NMED	8 days	Wed 2/24/16	Wed 3/2/16	11
13		NMED Review of Final	72 days	Thu 3/3/16	Fri 5/13/16	12
14		Receive Notice of Disapproval (NOD), Prepare RTCs and Submit	1 day	Mon 5/16/16	Mon 5/16/16	13
15		NMED Review and Acceptance of RTCs (Revise and Submit Slip Pages)	66 days	Tue 5/17/16	Wed 7/20/16	14
16		Prepare and Submit Revised Final CA Work Plan	14 days	Sat 7/23/16	Thu 8/4/16	15
17		Army and NMED Approval of Revised Final CA Work Plan	0 days	Fri 8/5/16	Fri 8/5/16	16
18		**Waste Excavation Plan (WEP)**	**291 days**	**Tue 2/7/17**	**Fri 11/24/17**	
19		Prepare and Submit Draft	15 days	Tue 2/7/17	Tue 2/21/17	
20		Army Review of Draft	15 days	Wed 2/22/17	Wed 3/8/17	19
21		Address Comments and Prepare Draft Final	5 days	Thu 3/9/17	Mon 3/13/17	20
22		Army Review of Draft Final	5 days	Tue 3/14/17	Sat 3/18/17	21
23		Prepare Final and Submit to NMED	5 days	Sun 3/19/17	Thu 3/23/17	22
24		NMED Review of Final	15 days	Fri 3/24/17	Fri 4/7/17	23



Project: Environmental Remedi
Date: Mon 10/9/17

Task	Summary	Inactive Milestone	Duration-only	Start-only	External Milestone	Manual Progress
Split	Project Summary	Inactive Summary	Manual Summary Rollup	Finish-only	Deadline	
Milestone	Inactive Task	Manual Task	Manual Summary	External Tasks	Progress	

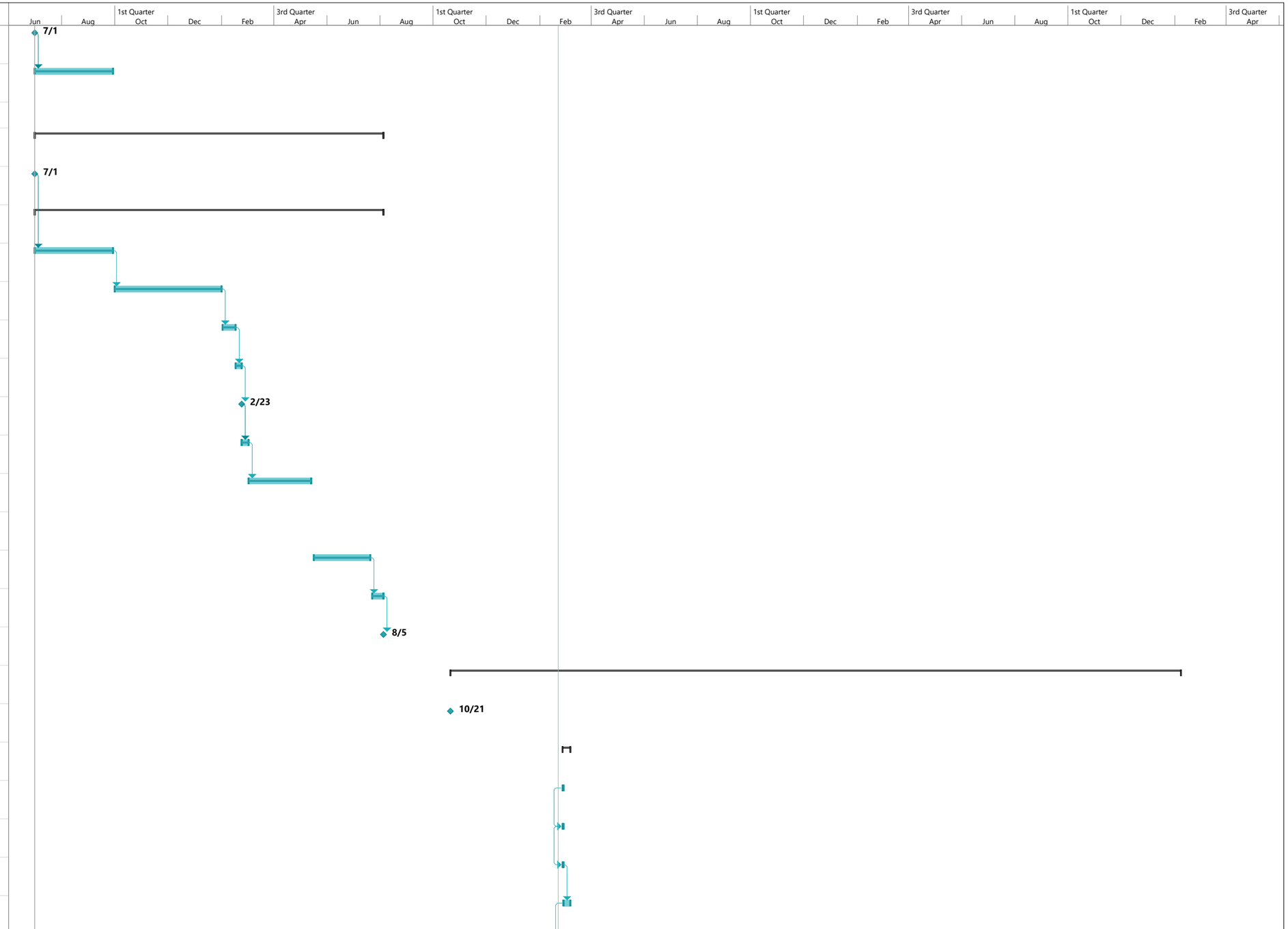
ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
25		Address Comments and Prepare Revised Final	200 days	Sat 4/8/17	Tue 10/24/17	24
26		NMED Review and Acceptance of RTC's	30 days	Wed 10/25/17	Thu 11/23/17	25
27		Army and NMED Approval of Revised WEP	1 day	Fri 11/24/17	Fri 11/24/17	26
28		**0011_(OPTION)_Complete CA and Final Report at Oro Grande Landfill - POP 24 months**	**1144 days**	**Fri 10/21/16**	**Mon 12/9/19**	
29		NTP for CLIN 0011	0 days	Fri 10/21/16	Fri 10/21/16	
30		**CA Implementation**	**19 days**	**Mon 12/11/17**	**Fri 12/29/17**	
31		Pre-Construction Meeting	1 day	Mon 12/11/17	Mon 12/11/17	27FS+10 days
32		Mobilization	1 day	Mon 12/11/17	Mon 12/11/17	31SS
33		Site Preparation	1 day	Mon 12/11/17	Mon 12/11/17	32SS
34		Soil Excavation	6 days	Tue 12/12/17	Tue 12/19/17	33
35		Backfilling	9 days	Thu 12/14/17	Wed 12/27/17	34SS+2 days
36		Site Restoration & Demobilization Complete	1 day	Fri 12/29/17	Fri 12/29/17	35
37		**CA Report**	**703 days**	**Fri 1/5/18**	**Mon 12/9/19**	
38		Prepare and Submit Draft	60 days	Fri 1/5/18	Mon 3/5/18	36
39		Army Review of Draft	45 days	Tue 3/6/18	Thu 4/19/18	38
40		Address Comments and Prepare Draft Final	30 days	Fri 4/20/18	Sat 5/19/18	39
41		Army Review of Draft Final	30 days	Sun 5/20/18	Mon 6/18/18	40
42		Army Approval of Draft Final CA Report	0 days	Tue 6/19/18	Tue 6/19/18	41
43		Prepare Final and Submit to NMED	14 days	Tue 6/19/18	Mon 7/2/18	42
44		NMED Review of Final	360 days	Tue 7/3/18	Thu 6/27/19	43
45		Receive Notice of Disapproval (NOD), Prepare RTCs and Submit	30 days	Fri 6/28/19	Sat 7/27/19	44
46		NMED Review and Acceptance of RTCs	120 days	Sun 7/28/19	Sun 11/24/19	45
47		Prepare and Submit Revised Final CA Report	14 days	Mon 11/25/19	Sun 12/8/19	46
48		Army and NMED Approval of Revised Final CA Report	0 days	Mon 12/9/19	Mon 12/9/19	47



Project: Environmental Remedi
Date: Mon 10/9/17

Task	Summary	Inactive Milestone	Duration-only	Start-only	External Milestone	Manual Progress
Split	Project Summary	Inactive Summary	Manual Summary Rollup	Finish-only	Deadline	
Milestone	Inactive Task	Manual Task	Manual Summary	External Tasks	Progress	

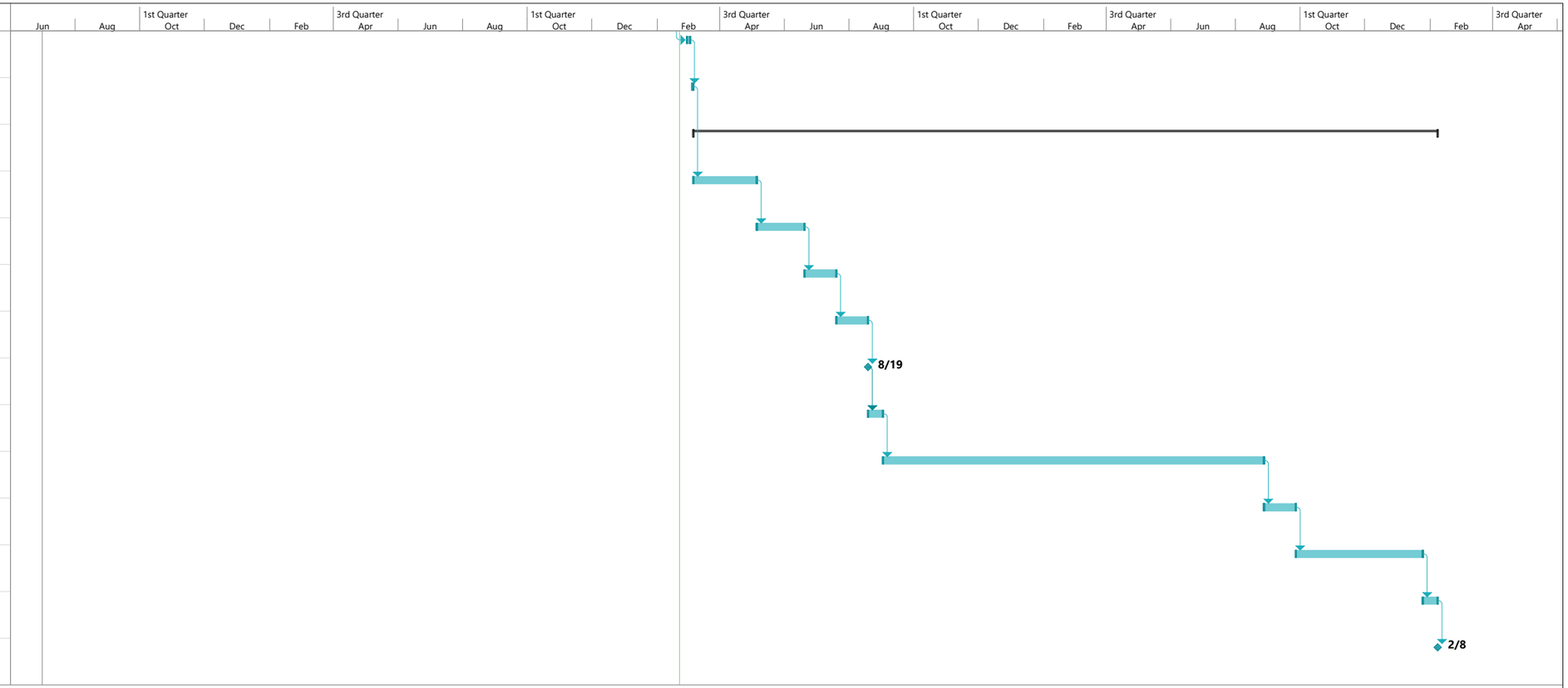
ID	Task Mode	Task Name	Duration	Start	Finish
1		Contract Award	0 days	Wed 7/1/15	Wed 7/1/15
2		OPSEC / iWatch / and Other Security Requirements	90 days	Wed 7/1/15	Mon 9/28/15
3		POP Completion Date	0 days	Tue 5/5/20	Tue 5/5/20
4		**0010_Complete a CA**	**401 days**	**Wed 7/1/15**	**Fri 8/5/16**
5		NTP for CLIN 0010	0 days	Wed 7/1/15	Wed 7/1/15
6		**CA Work Plan**	**401 days**	**Wed 7/1/15**	**Fri 8/5/16**
7		Prepare and Subr	91 days	Wed 7/1/15	Mon 9/28/15
8		Army Review of [	124 days	Thu 10/1/15	Sun 1/31/16
9		Address Commer	15 days	Tue 2/2/16	Tue 2/16/16
10		Army Review of [	7 days	Wed 2/17/16	Tue 2/23/16
11		Army Approval o	0 days	Tue 2/23/16	Tue 2/23/16
12		Prepare Final anc	8 days	Wed 2/24/16	Wed 3/2/16
13		NMED Review of	72 days	Thu 3/3/16	Fri 5/13/16
14		Receive Notice o	0 days	Mon 5/16/16	Mon 5/16/16
15		NMED Review an	66 days	Tue 5/17/16	Wed 7/20/16
16		Prepare and Subr	14 days	Sat 7/23/16	Thu 8/4/16
17		Army and NMED	0 days	Fri 8/5/16	Fri 8/5/16
18		**0011_(OPTION)_Com**	**840 days**	**Fri 10/21/16**	**Fri 2/8/19**
19		NTP for CLIN 0011	0 days	Fri 10/21/16	Fri 10/21/16
20		**CA Implementation**	**9 days**	**Mon 2/27/17**	**Tue 3/7/17**
21		Pre-Construction	1 day	Mon 2/27/17	Mon 2/27/17
22		Mobilization	1 day	Mon 2/27/17	Mon 2/27/17
23		Site Preparation	1 day	Mon 2/27/17	Mon 2/27/17
24		Soil Excavation	6 days	Tue 2/28/17	Tue 3/7/17



Project: Environmental Remedi
Date: Wed 2/22/17

Task	Summary	Inactive Milestone	Duration-only	Start-only	External Milestone	Manual Progress
Split	Project Summary	Inactive Summary	Manual Summary Rollup	Finish-only	Deadline	
Milestone	Inactive Task	Manual Task	Manual Summary	External Tasks	Progress	

ID	Task Mode	Task Name	Duration	Start	Finish
25		Backfilling	3 days	Wed 3/1/17	Fri 3/3/17
26		Site Restoration &	1 day	Mon 3/6/17	Mon 3/6/17
27		**CA Report**	**703 days**	**Tue 3/7/17**	**Fri 2/8/19**
28		Prepare and Subr	60 days	Tue 3/7/17	Fri 5/5/17
29		Army Review of D	45 days	Sat 5/6/17	Mon 6/19/17
30		Address Commer	30 days	Tue 6/20/17	Wed 7/19/17
31		Army Review of D	30 days	Thu 7/20/17	Fri 8/18/17
32		Army Approval o	0 days	Sat 8/19/17	Sat 8/19/17
33		Prepare Final anc	14 days	Sat 8/19/17	Fri 9/1/17
34		NMED Review of	360 days	Sat 9/2/17	Mon 8/27/18
35		Receive Notice o	30 days	Tue 8/28/18	Wed 9/26/18
36		NMED Review an	120 days	Thu 9/27/18	Thu 1/24/19
37		Prepare and Subr	14 days	Fri 1/25/19	Thu 2/7/19
38		Army and NMED	0 days	Fri 2/8/19	Fri 2/8/19

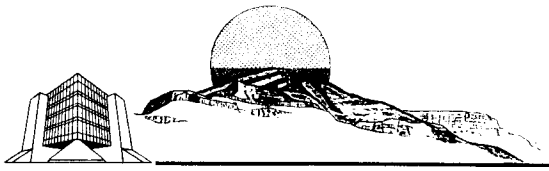


Project: Environmental Remedi
Date: Wed 2/22/17

Task	Summary	Inactive Milestone	Duration-only	Start-only	External Milestone	Manual Progress
Split	Project Summary	Inactive Summary	Manual Summary Rollup	Finish-only	Deadline	
Milestone	Inactive Task	Manual Task	Manual Summary	External Tasks	Progress	

APPENDIX G

WASTE ACCEPTANCE LETTER FROM OTERO-GREENTREE LANDFILL



City of Alamogordo

March 30, 2017

Cape Environmental Management, Inc.

12037 Starcrest

San Antonio, TX 78247

(b) (6) [redacted]

In Re; Orogrande Landfill Project

Mr. Miller,

Contingent upon the requirements and approval of the waste from the New Mexico Environmental Department, and after receiving our copy from the Environmental Department stating that we are permitted to take the waste per NMED requirements we accept the waste to be disposed of at the Otero Co./Greentree Regional Landfill.

(b) (6) [redacted] o Co./Greentree Regional Landfill

APPENDIX H

EMERGENCY CONTACT LIST

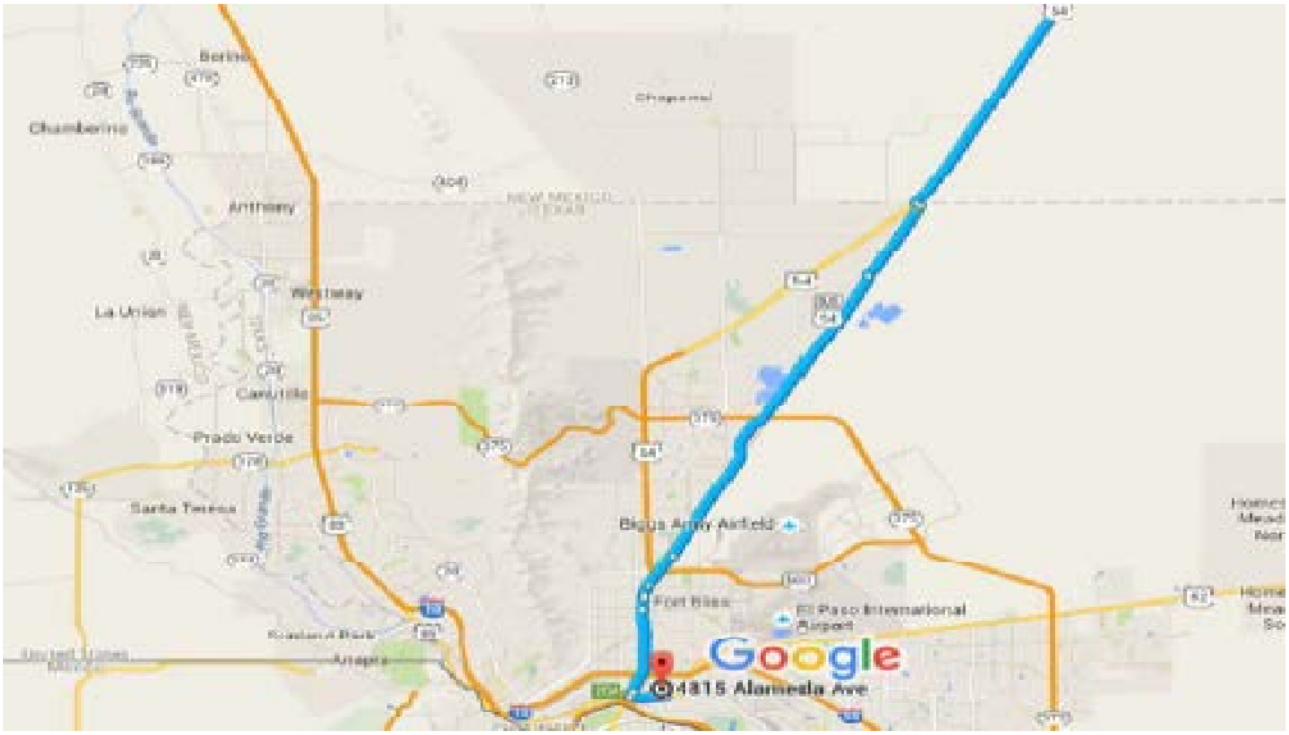
EMERGENCY CONTACT LIST

Ambulance/Paramedics/Fire/Police – Emergency	9-1-1
Emergency Hospital: University Medical Center of El Paso 4815 Alameda Avenue, El Paso, TX 79905	Telephone: (915) 544-1200 Website: umcelpaso.org
Base Security: TBD Base Security Dispatch Office	Telephone:
Fort Bliss POC (b) (6)	Office: (b) (6) (b) (6)
US Army Environmental Command Contracting POC: Mike Bowlby 2450 Connell Road Fort Sam Houston, TX 78234	Office: (210) 466-1686 Email: michael.a.bowlby.civ@mail.mil
US Army Corps of Engineers COR: (b) (6)	Office: (b) (6) Email: (b) (6)
CAPE (Project Office – San Antonio, TX) 404 E. Ramsey, Suite 206, San Antonio, TX 78216	Office: (808) 791-6880 FAX: (808) 791-6888
CAPE (Corporate - Atlanta, GA) 500 Pinnacle Court, Suite 100, Norcross, GA 30071	Office: (770) 908-7200 FAX: (770) 908-7219
CAPE Project Manager (b) (6)	Office: Mobile: (b) (6) (b) (6)
CAPE Site Superintendent/SSHO (b) (6)	(b) (6) (b) (6)
CAPE Safety and Health Manager (b) (6)	(b) (6) (b) (6) (b) (6)
CAPE SVPRM Corporate Risk Manager (b) (6)	(b) (6) inc.com
CAPE Corporate Human Resources Manager (b) (6)	(b) (6) (b) (6) (b) (6)

APPENDIX I

EMERGENCY HOSPITAL ROUTE MAP

EMERGENCY HOSPITAL ROUTE MAP



Emergency Hospital:
University Medical Center of El Paso
4815 Alameda Avenue, El Paso, TX 79905
(915) 544-1200

Emergency Hospital Route: Estimated Time: 50 minutes;
Starting from Oro Grande Landfill, NM.
Head south on US-54 W toward El Paso, TX;
Turn LEFT onto State Line Road (0.2 miles);
Turn RIGHT onto Dyer Street (2.7 miles);
Turn LEFT onto Railroad Drive (10.5 miles);
Keep RIGHT to stay on Railroad Drive (1.2 miles);
Merge onto Gateway S. Blvd (0.3 miles);
Use the left 2 lanes to merge onto US-54 W towards Juarez (0.4 miles);
Continue on US-54W; take exit 20A for US-62 toward Paisano Drive (2.9 miles);
Turn LEFT onto US-62 E Paisano Drive (0.9 miles);
Turn LEFT onto S. Val Verde Street (0.1 miles);
Turn LEFT onto Alameda Avenue (0.1 miles);
The hospital will be on the right at 4815 Alameda Avenue, El Paso, TX 79905.

NOTE: SSHO must drive emergency hospital route before start of field work.

Quality Assurance Project Plan

Munitions and Explosives of Concern Characterization and Munitions Constituents Sampling

Remedial Investigation/Feasibility Study

for Area of Interest North of Castner Range

El Paso, Texas

Contract Number: W912DY-10-D-0027 – Delivery Order: DS01

July 2018

Version: Final, Revision 0

Prepared for

U.S. Army Corps of Engineers, Tulsa District

CECT-SWT-E

1645 South 101st East Ave.

Tulsa, Oklahoma 74128

Prepared by

KEMRON Environmental Services, Inc.

1359A Ellsworth Industrial Blvd.

Atlanta, GA 30318

404-636-0928

LIST OF FIGURES

LIST OF PHOTOGRAPHS

LIST OF APPENDICES

Acronym List

°C	degree Celsius
°F	degree Fahrenheit
2,4-DNT	2,4-dinitrotoluene
2,6-DNT	2,6-dinitrotoluene
2-Am-DNT	2-amino-4,6-dinitrotoluene
4-Am-DNT	4-amino-2,6-dinitrotoluene
ADR	automated data review
AES	atomic emission spectroscopy
amsl	above mean sea level
ANSI	American National Standards Institute
AOI	area of interest
APP	Accident Prevention Plan
Army	U.S. Department of the Army
ASQ	American Society for Quality
ATV	all-terrain vehicle
BIP	blow-in-place
BSI	blind seed item
CAP	Corrective Action Plan
CAR	Corrective Action Request
CCB	continuing calibration blank
CCV	continuing calibration verification
CFR	Code of Federal Regulations
CHMM	Certified Hazardous Materials Manager
cm	centimeter
COC	contaminant of concern
CPR	cardiopulmonary resuscitation
CQCM	Corporate Quality Control Manager
CRP	Community Relations Plan
CRREL	Cold Regions Research Engineering Laboratory
CSM	conceptual site model
DAR	Daily Activity Report
DD	Decision Document
DDESB	Department of Defense Explosives Safety Board

DFW	definable feature of work
DGM	digital geophysical mapping
DL	detection limit
DoD	U.S. Department of Defense
DQI	data quality indicator
DQO	data quality objective
DU	decision unit
DVR	Data Validation Report
EDD	electronic data deliverable
eDMS	Environmental Data Management System
EIT	engineer-in-training
ELAP	Environmental Laboratory Accreditation Program
EOD	explosive ordnance disposal
EM	Engineer Manual
EM	electromagentic
EM61	Geonics EM61-MK2
EPA	U.S. Environmental Protection Agency
ERPIMS	Environmental Resources Program Information Management System
ESP	Explosives Site Plan
EZ	exclusion zone
FA	first aid
FCA	function check area
FM	Field Manager
FP	follow-up phase
FS	feasibility study
GIS	geographic information system
GPS	global positioning system
GSV	geophysical system verification
HAZWOPER	Hazardous Waste Operations and Emergency Response
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HPLC	high-performance liquid chromatography
ICAL	initial calibration
ICB	initial calibration blank
ICP	inductively coupled plasma

ICS	interference check solutions
ICV	initial calibration verification
IDQTF	Intergovernmental Data Quality Task Force
IP	initial phase
IRTC	Interstate Technology Regulatory Council
IS	incremental sampling
ISM	incremental sampling methodology
ISO	industry standard object
IVS	instrument verification strip
KEMRON	KEMRON Environmental Services, Inc.
kg	kilogram
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LIMS	laboratory information management system
LOD	limit of detection
LOQ	limit of quantitation
LR	laboratory replicate
MB	method blank
MC	munitions constituents
MD	munitions debris
MDAS	material documented as safe
MDEH	material documented as an explosive hazard
MEC	munitions and explosives of concern
mg/kg	milligram per kilogram
mm	millimeter
MMRP	Military Munitions Response Program
MPC	measurement performance criteria
MPPEH	material potentially presenting an explosive hazard
MQO	measurement quality objective
MS	matrix spike or mass spectroscopy
MSD	matrix spike duplicate
mV	millivolt
NA	not applicable
NELAP	National Environmental Laboratory Accreditation Program

NFA	No Further Action
NG	nitroglycerin
NRO	Non-Routine Occurrence Report
OB	open burn
OD	open detonation
OESS	Ordnance and Explosives Safety Specialist
PAL	project action limit
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
PBR	performance-based remediation
PCL	protective concentration level
PDS	post-digestion spike
PETN	pentaerythritol tetranitrate
PG	Professional Geologist
PLS	Professional Land Surveyor
PM	Project Manager
PMP	Project Management Professional
PP	Proposed Plan or preparatory phase
PT	performance testing
PVC	polyvinyl chloride
QA	quality assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	quality control
RCA	Root-Cause Analysis
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	remedial investigation
RPD	relative percent difference
RSD	relative standard deviation
RTK	real-time kinematic
S1VM	stage 1 validation, manual
S2AVE	stage 2A validation, electronic
S2BVEM	stage 2B validation, electronic and manual
S4VEM	stage 4 validation, electronic and manual
SOP	standard operating procedure

SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
TBD	to be determined
TCEQ	Texas Commission on Environmental Quality
tetryl	methyl-2,4,6-trinitrophenylnitramine
TM	Task Manager
TNT	2,4,6-trinitrotoluene
TP	technical paper
TPP	technical project planning
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Command
USC	U.S. Code
UV	ultraviolet
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
VSP	Visual Sample Plan

EXECUTIVE SUMMARY

U.S. Army Corps of Engineers (USACE) is conducting a remedial investigation/feasibility study (RI/FS) in the Area of Interest (AOI) North of Castner Range, El Paso, Texas, under the Defense Environmental Restoration Program, Military Munitions Response Program (MMRP). KEMRON Environmental Services, Inc. (KEMRON) will perform all work in accordance with federal, state, and local statutes, regulations, and guidance. The Texas Commission on Environmental Quality (TCEQ) and U.S. Environmental Protection Agency (EPA) Region 6 are the regulatory agencies for this site. TCEQ is the lead regulatory agency. As such, all associated work will be consistent with the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986, and National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations [CFR]§300) requirements, and under the state of Texas Voluntary Cleanup Program with regulatory coordination, as appropriate, of TCEQ. The AOI North of Castner Range is not on the National Priorities List.

The U.S. Department of Defense (DoD) established the MMRP to address military munitions located on current and formerly used defense sites. Based on historical records and past work, this site may contain munitions and explosives of concern (MEC). MEC are: 1) unexploded ordnance (UXO), as defined in 10 U.S. Code (USC) 101I(5); 2) discarded military munitions, as defined in 10 USC 2710I(2); and/or 3) munitions constituents (MC) (e.g., 2,4,6-trinitrotoluene [TNT]; octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine [HMX]; and hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX]) present in soil, facilities, equipment, or other materials in high enough concentrations to pose an explosive hazard.

The AOI North of Castner Range is 7,936 acres in El Paso County, Texas. It is located north of the Closed Castner Range, not owned by Fort Bliss, and is bounded by Martin Luther King Boulevard on the east and the Franklin Mountains State Park on the west. Housing developments exist to the southeast and a quarry is in operation just north of the northern boundary. The buildings currently onsite include those related to ranching activities. The Archeology Museum and the Border Patrol Museum are located to the south, on the Closed Castner Range. The site location is shown in **Figure 1-1**.

The current project involves field work to collect data, a RI/FS based on the field work, and achieving stakeholder acceptance of a Proposed Plan (PP) and Decision Document (DD) for the 5,860-acre investigation area of AOI North of Castner Range at Fort Bliss in El Paso County, Texas.

This Quality Assurance Project Plan (QAPP) contains a combination of MEC and chemical requirements and is based on the optimized worksheets in Uniform Federal Policy for Quality Assurance Project Plans: Optimized UFP-QAPP Worksheets (Intergovernmental Data Quality Task Force [IDQTF], 2012). The QAPP is intended to provide standard procedures and processes to support the RI/FS for the AOI North of Castner Range, El Paso, Texas. The included worksheets will serve as a guideline for project activities and data quality assessment. They describe the planning, implementation, acquisition, management, analysis, and assessment of data using effective methodologies and QC activities that will be used during the RI/FS. This document is intended for use by field operators, supervisors, data managers, and other technical experts responsible for implementing and coordinating field activities for the project. The appendices to the QAPP are listed below.

- **Appendix A** Accident Prevention Plan and Site Safety and Health Plan
- **Appendix B** Environmental Protection Plan
- **Appendix C** Waste Management Plan
- **Appendix D** Explosives Management Plan
- **Appendix E** Explosives Site Plan
- **Appendix F** Community Relations Plan
- **Appendix G** Laboratory Information
- **Appendix H** Standard Operating Procedures

- **Appendix I** Blind Seed Firewall Plan
- **Appendix J** Forms

The following appendices have been determined by the planning team to not be applicable to the project.

- Property Management Plan
- IHF Siting Plan

All other appendices are applicable to the project and are attached to the QAPP or were submitted under separate cover and are incorporated by reference to this QAPP. This QAPP is also supported by the Explosives Site Plan (ESP), which governs explosives safety for the project.

QAPP WORKSHEET #1 & 2: TITLE AND APPROVAL PAGE

Site Name:	Area of Interest North of Castner Range
Site Location:	El Paso, Texas
Document Title:	Quality Assurance Project Plan, Munitions and Explosives of Concern Characterization and Munitions Constituents Sampling Remedial Investigation/Feasibility Study for Area of Interest North of Castner Range, El Paso, Texas
Contract Number:	W912DY-10-D-0027 – Delivery Order: DS01

Investigative Organization

AUTHOR SIGNATURE

Date: 13 July 2018

Date: 13 July 2018

REVIEW SIGNATURES

Date: 13 July 2018

Date: 16 July 2018

Date: 16 July 2018

Contracting Organization

See Appendix K for Signature Date: _____

USACE Project Manager

See Appendix K for Signature Date: _____

Army Environmental Control Manager

See Appendix K for Signature Date: _____

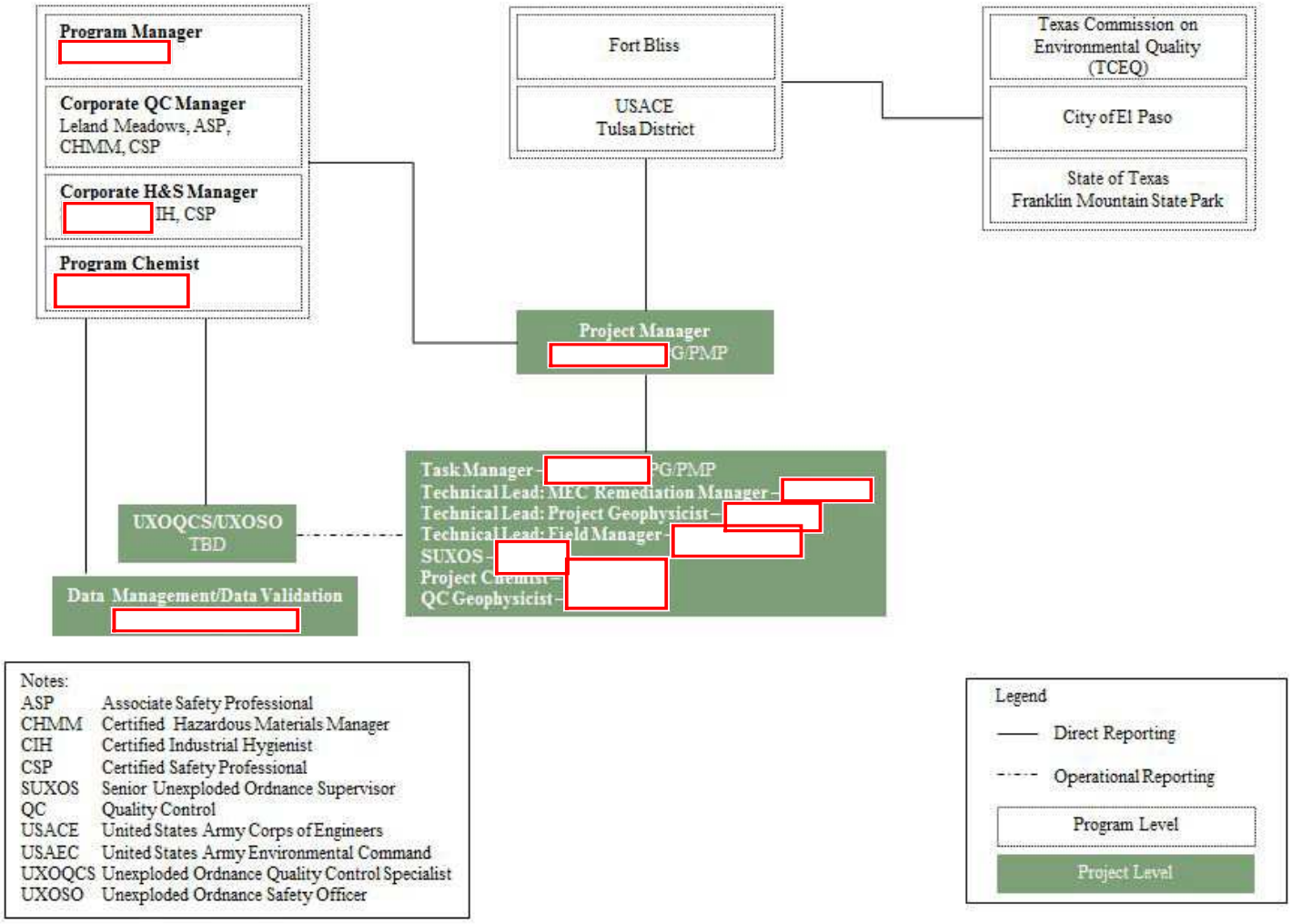
USACE Ordnance and Explosives Safety Specialist

See Appendix K for Signature Date: _____

Texas Commission on Environmental Quality

QAPP WORKSHEET #3 & 5: PROJECT ORGANIZATION AND QAPP DISTRIBUTION

Figure 1-1. Organizational Structure



QAPP WORKSHEET #4, 7, & 8: PERSONNEL QUALIFICATIONS AND SIGN-OFF SHEET

ORGANIZATION: KEMRON

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Ralph Brooks	Program Manager	AS – Military technology BS – General studies 38 years of combined military and MMRP with Senior Unexploded Ordnance Supervisor (SUXOS) project and program management experience.	Naval Explosive Ordnance Disposal (EOD) School Hazardous Waste Operations and Emergency Response (HAZWOPER)	
Leland Meadows, ASP, CHMM, CSP	Corporate Quality Control Manager (CQCM)	BS – Chemistry with a Minor in Math, Alabama Agricultural & Mechanical University 2001 Safety & Health Program Management Certificate, GA Tech, 2014 16 years of quality process improvement and health and safety management	Certified Hazardous Materials Manager (CHMM) – #15985, 2012 OPSEC Level II Coordinator, Certified Safety Professional - #31840, 2016, 40-hour HAZWOPER (OSHA 29 CFR 1920.120); Annual 8-hour HAZWOPER updates	
Steve Fess, CIH, CSP	Corporate Health and Safety Manager	AAS - Medical Laboratory Technology BS – Health Sciences (Safety/ Environmental) ISO 14001 Program Management 36 Years Safety and Industrial Hygiene experience with a Fortune 100 Company and as a consultant with numerous firms	Certified Industrial Hygienist (CIH) – #5926 CP 1993, Certified Safety Professional - #9151, 1989, 40-hour HAZWOPER (OSHA 29 CFR 1920.120); Annual 8-hour HAZWOPER updates, OSHA 30-Hour General Industry Outreach / 30-Hour Construction Outreach Classes ISO 14001 EMS Lead Auditor Training/ ISO 9001 QMS Auditor Training	
Dan Burnett, PG, PMP	Project Manager	BS – Forestry, Water Resources MS – Geology 15 years of experience	Project Management Professional Professional Geologist 40-hour HAZWOPER (OSHA 29 CFR 1920.120); Annual 8-hour HAZWOPER updates	

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
John Stine	SUXOS	Senior NCO Academy U.S. Navy EOD School, Munitions Disposal Specialist U.S. Air Force Munitions Maintenance Specialist Master EOD Technician Master EOD Training Instructor, USAF Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP)-18-qualified SUXOS 39 years of UXO and MMRP experience, with 32 years of supervisory experience	USACE UXO #0539 40-hour HAZWOPER (OSHA 29 CFR 1920.120); Annual 8-hour HAZWOPER updates; OSHA 8-hour Supervisor Course; OSHA 30-hour Construction Safety; Capable of performing as UXOSO and/or UXOQCS	
TBD	Unexploded Ordnance Quality Control Specialist (UXOQCS)/ Unexploded Ordnance Safety Officer (UXOSO)	Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP)-18-qualified		
Alex Mussio	Quality Control Geophysicist	B.S., Geology and Planetary Sciences, University of Pittsburgh at Johnstown, PA, 1999 8+ years of MMRP geophysical and QC experience	2000/29 CFR 1910.120 40 Hour OSHA Health and Safety Training 2001/AGI EI StingR1/SuperSting R8 2003/GSSI SIR-3000 2003/GSSI StructureScan 2006/GSSI BridgeScan Survey Training 2006/CPR & First Aid Training 2007/29 CFR 1910.120 (e)(4) 8 Hour Training for Supervisors 2008/ KGS MASW (multi-channel analysis of shear waves) Training 2010/Geosoft Oasis Montaj Training I and II 2017/29 CFR 1910.120 8 Hour (Annual refresher	

ORGANIZATION: GILBANE

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Terry Hardy, PG, PMP	Task Manager (TM)	BS Geology, 28 years of experience	PG #25 (AL);#1942 (FL); #1245 (GA); #761 (LA); #1472 (NC); #2042 (SC); #2377 (TN);#2801001106 (VA) PMP #1539077, 40-hour HAZWOPER (OSHA 29 CFR 1920.120); Annual 8-hour HAZWOPER updates	
Evelyn Dawson, CHMM, PMP	Program Chemist	BS Chemistry, 28 years of experience Oversees QA/QC, laboratory, data management, and data validation	CHMM #15380, PMP #1766049, QA/QC experience; familiar with laboratory methods and procedures, auditing, data validation, field procedures, and data management. 40-hour HAZWOPER (OSHA 29 CFR 1920.120); Annual 8-hour HAZWOPER updates; 30-Hour Construction Safety; CPR, FA	
Jerry Grose	MEC Remediation Manager	DoD DDESB TP-18-qualified SUXOS (DDESB, 2015) 24 years of EOD and UXO experience	Naval EOD School; USACE Construction Quality Management training; 40-hour HAZWOPER (OSHA 29 CFR 1920.120); Annual 8-hour HAZWOPER updates; HAZWOPER Supervisor; 30-Hour Construction Safety; 10-Hour Construction Safety	
Andy Gascho	Project Geophysicist	MS Geophysics, 17 years of MMRP geophysics experience 5 years of geophysical classification experience on 9 geophysical classification projects	Oasis montaj Geophysical Data Processing for UXO Environmental Security Technology Certification Program, Geosoft UX-Analyze Training; 40-hour HAZWOPER (OSHA 29 CFR 1920.120); Annual 8-hour HAZWOPER updates; 30-Hour Construction Safety	

ORGANIZATION: GILBANE (Cont.)

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Rebecca Pisha	Field Manager (FM)	BA Environmental Science, 10 years of MMRP environmental investigation. Community relations experience at Fort Bliss.	40-hour HAZWOPER (OSHA 29 CFR 1920.120); Annual 8-hour HAZWOPER updates; OSHA 8-hour HAZWOPER Supervisor Course; OSHA 30-hour Construction Safety Course; Construction Quality Management for Contractors Training; Safety Trained Supervisor; Wilderness First Aid, CPR	
Tom Beer, EIT	Project Chemist	BS Chemistry, 34 years of experience. specializing in preparing sample plans and QAPPs, field sampling logistics and sample collection, data management, data review and validation, and report preparation. He has reviewed and approved project SAPs and QAPPs, and validated MMRP data. Specifically familiar with ISM sampling; and validation/review of explosives, polycyclic aromatic compounds, and metals.	EIT #115026 40-hour HAZWOPER (OSHA 29 CFR 1920.120); Annual 8-hour HAZWOPER updates; CPR, FA. Data review experience; familiar with laboratory methods and procedures, data validation, and field procedures	

ORGANIZATION: Laboratories/Validation Companies

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Dilea Bindel TestAmerica	Project Manager	BS Biology 13 years laboratory experience	Familiar with laboratory quality systems including methods.	
Sue Bell SGS Accutest	Project Manager	BS Chemistry/Math 25 years laboratory experience	Familiar with laboratory quality systems including methods, sample preparation and analysis.	
Laura Deck Synectics	Database Specialist	BS Environmental Studies 8 years of experience	Familiar with managing data, troubling shooting data uploads, familiar with laboratory procedures, event planning, database setup, data entry, assisting the laboratory with electronic data deliverable uploads.	

Signatures indicate personnel have read and agree to implement this QAPP as written.

QAPP WORKSHEET #6A: COMMUNICATION PATHWAYS (MEC)

Communication Driver	Organization/ Role	Name	Contact Information	Procedure (Timing, pathway, documentation, etc.)
Lead Agency	USACE Tulsa, PM			All appropriate materials and information about the project, such as reports, plans, technical memos, meeting minutes, etc., will be forwarded to the USACE PM in written form by common carrier and/or email by KEMRON within a reasonable time frame as dictated by the type of material or information that is to be transmitted. Mr. Smith will be the primary point of contact with the regulatory agencies.
Supporting Organization	USACE Tulsa, TM			All appropriate materials and information about the project, such as reports, plans, technical memos, meeting minutes, etc., will be forwarded to the USACE TM in written form by common carrier and/or email by KEMRON within a reasonable time frame as dictated by the type of material or information that is to be transmitted.
Supporting Organization	USAEC-Midwest Division, Environmental Restoration Manger (ERM)			All appropriate materials and information about the project, such as reports, plans, technical memos, meeting minutes, etc., will be forwarded to the USACE ERM in written form by common carrier and/or email by KEMRON within a reasonable time frame as dictated by the type of material or information that is to be transmitted.
Supporting Organization	Fort Bliss Installation Environmental Contact			All appropriate materials and information about the project, such as reports, plans, technical memos, meeting minutes, etc., will be forwarded to Fort Bliss in written form by common carrier and/or email by KEMRON within a reasonable time frame as dictated by the type of material or information that is to be transmitted.
Regulatory Organization	TCEQ			All appropriate materials and information about the project, such as reports, plans, technical memos, meeting minutes, etc., will be forwarded to TCEQ in written form by common carrier and/or email by the USACE TM/PM within a reasonable time frame as dictated by the type of material or information that is to be transmitted.
Field Progress Reports	KEMRON, PM			Daily reports to be provided to the USACE PM at the end of each day of field work (Appendix J, Forms M-14 and M-15).

Communication Driver	Organization/ Role	Name	Contact Information	Procedure (Timing, pathway, documentation, etc.)
Stop work due to safety issue(s)	KEMRON, UXOSO	TBD	--	All field personnel are authorized to stop work if a condition arises; however; the UXOSO is the point of contact and informs the KEMRON PM and Corporate Health and Safety Manager of critical safety issue(s). OESS and USACE PM/COR are notified of any safety violation and are sent a report summarizing the incident.
Potential hazardous or unsafe conditions that raise question of stopping work	Gilbane, FM Gilbane, Project Geophysicist KEMRON, UXOSO			All field personnel are authorized to stop work if a condition arises; however; the FM, Project Geophysicist, or UXOSO can inform the KEMRON PM and Corporate Health and Safety Manager of potential safety issue(s). The FM is the point of contact and will develop the report. Ordnance and Explosives Safety Specialist (OESS) and USACE Project Manager informed of issue(s) and receive report.
Geonics EM61-MK2 (EM61) data and anomaly selection	Gilbane, Project Geophysicist			The Project Geophysicist reviews digital geophysical mapping (DGM) data and anomalies generated and provides the data/ target list to the USACE QA Geophysicist for review and approval.
Blind seeding information	KEMRON, UXOQCS KEMRON, QC Geophysicist			UXOQCS and QC Geophysicist communicate directly with USACE QA Geophysicist regarding blind seeding information in accordance with the Blind Seed Firewall Plan (**Appendix I**).
Quality control variances	KEMRON, UXOQCS KEMRON, QC Geophysicist			UXOQCS and QC Geophysicist prepare (as applicable) a Root-Cause Analysis (RCA), Corrective Action Request (CAR; Appendix J, Form QC-1) and Corrective Action Plan (CAP; Appendix J, Form QC-2). Forms are provided to USACE QA Geophysicist, and Project Manager for review and approval.
Data verification issues (e.g., incomplete records)	Gilbane, MEC RM Gilbane, Project Geophysicist			MEC Remediation Manager and the Project Geophysicist prepare (as applicable) an RCA, CAR, and CAP. Forms are provided to USACE QA Geophysicist and USACE Ordnance and Explosives Safety Specialist (OESS) for review and approval.
DGM data review corrective actions	KEMRON, QC Geophysicist			QC Geophysicist prepares (as applicable) an RCA, CAR, and CAP. Forms are provided to USACE QA Geophysicist and USACE Ordnance and Explosives Safety Specialist (OESS) for review and approval.

QAPP WORKSHEET #6B: ADDITIONAL COMMUNICATION PATHWAYS (MC)

Communication Driver	Organization/ Role	Name	Contact Information	Procedure (Timing, pathway, documentation, etc.)
Lead Agency	USACE Tulsa, PM			All appropriate materials and information about the project, such as reports, plans, technical memos, meeting minutes, etc., will be forwarded to the USACE PM in written form by common carrier and/or email by KEMRON within a reasonable time frame as dictated by the type of material or information that is to be transmitted. Mr. Smith will be the primary point of contact with the regulatory agencies.
Supporting Organization	USACE Tulsa, TM			All appropriate materials and information about the project, such as reports, plans, technical memos, meeting minutes, etc., will be forwarded to the USACE TM in written form by common carrier and/or email by KEMRON within a reasonable time frame as dictated by the type of material or information that is to be transmitted.
Supporting Organization	USAEC-Midwest Division, Environmental Restoration Manger (ERM			All appropriate materials and information about the project, such as reports, plans, technical memos, meeting minutes, etc., will be forwarded to the USACE ERM in written form by common carrier and/or email by KEMRON within a reasonable time frame as dictated by the type of material or information that is to be transmitted.
Supporting Organization	Fort Bliss Installation Environmental Contact			All appropriate materials and information about the project, such as reports, plans, technical memos, meeting minutes, etc., will be forwarded to Fort Bliss in written form by common carrier and/or email by KEMRON within a reasonable time frame as dictated by the type of material or information that is to be transmitted.
Regulatory Organization	TCEQ			All appropriate materials and information about the project, such as reports, plans, technical memos, meeting minutes, etc., will be forwarded to TCEQ in written form by common carrier and/or email by KEMRON within a reasonable time frame as dictated by the type of material or information that is to be transmitted.
Field Progress Reports	KEMRON, PM			Daily reports to be provided to the USACE PM at the end of each day of field work (Appendix J, Forms M-14 and M-15).

Communication Driver	Organization/ Role	Name	Contact Information	Procedure (Timing, pathway, documentation, etc.)
Stop work due to safety issue(s)	Gilbane, FM			All field personnel are authorized to stop work if a condition arises; however; the Gilbane FM is the point of contact and informs KEMRON PM and Corporate Health and Safety Manager about critical safety issue(s). USACE PM/COR are notified of any safety violation and are sent a report summarizing the incident.
Potential hazardous or unsafe conditions that raise question of stopping work	Gilbane, FM			All field personnel are authorized to stop work if a condition arises; however; the Gilbane FM is the point of contact and informs KEMRON PM and Corporate Health and Safety Manager of potential safety issue(s) and develops report. USACE Project Manager informed of potential issue and receives report.
Sampling variances	Gilbane, FM Gilbane Synectics			Variances from planned sampling will be corrected on the chain-of-custody record by the sampler and corrected via email to the laboratory within 48 hours of sampling by the project chemist or database specialist.
Laboratory quality control variances	TestAmerica			All QA/QC issues with project field samples will be reported by the laboratory to laboratory QAM within 2 business days. Any systemic variances identified by the QAM will be reported to the Program Chemist for review. All variances will be reported on an out-of-control form.
Standard operating procedures (SOPs) variances or procedural updates	TestAmerica			Any variances to the standard laboratory procedures described in the QSM or SOPs will be provided to the Program Chemist for review and project approval. Upon expiration, renewed laboratory documents will be provided for the project file.
Field / analytical corrective actions and proposed QAPP modifications	Gilbane, Program Chemist			FCR forms will be initiated by the field staff and reviewed and approved by the Program Chemist prior to implementation. Any resulting QAPP amendments will be reviewed and approved by the Project Manager and regulatory agency.

QAPP WORKSHEET #9: TECHNICAL PROJECT PLANNING SESSION SUMMARY

Project meetings will be held on an as-needed basis to discuss planning, scheduling, and logistics and may include operational discussions related to project decisions, deliverables, QC issues or concerns, corrective actions, and data presentation to support decision making. Meeting attendees will be based on the topics of discussion and may include subject matter experts. Project meeting agendas will be drafted by KEMRON and approved by USACE before dissemination to meeting attendees. Meeting minutes will be generated by KEMRON, reviewed and approved by USACE, and maintained by KEMRON.

If conducted, external project planning sessions will be included in future versions of this QAPP. Meeting minutes will contain a list of all participants, meeting agendas, detailed description of discussions, and action items.

A project kick-off meeting was held with the U.S. Army (Army) and U.S. Army Environmental Command (USAEC) at Fort Bliss to establish expectations and project end-state objectives. The participants are listed below.

Date: 07 December 2016
Location: El Paso, TX
Purpose: Kick-off Meeting

Name	Organization
	USACE
	USACE
	USACE
	USACE
	USAEC
	Fort Bliss
	Fort Bliss
	KEMRON
	Gilbane
	Gilbane
	Gilbane
	Gilbane

The project team, roles, responsibilities, contact information, and lines of communication were discussed. The team also discussed project documents, project objectives, project schedule and future technical project planning (TPP) meetings.

Date: 19 January 2017
Location: El Paso, TX
Purpose: TPP Meeting

Name	Organization
	USACE
	USACE
	USACE
	USACE
	USAEC
	Fort Bliss
	Fort Bliss
	KEMRON
	Gilbane
	Gilbane
	TCEQ
	TCEQ
	TCEQ
	UXO Pro
	FMSP
	EPWU
	EPWU
	FMWC

The high points from the TPP meeting discussion are bulleted below.

- Only soil samples will be collected.
- A combination of incremental sampling (IS) and biased composite sampling will be used to collect representative soil samples.
- A decision unit (DU) of 1 acre will be comprised of 50 increments.
- Locations of MEC finds, visual observations, results of the geophysical surveys, and ecological habitats will be considered when selecting DU locations.
- Compounds of concern were reiterated.
- The Texas Tier 1 protective concentration levels (PCLs) are the default screening levels.

Date: 27 June 2017
Location: El Paso, TX
Purpose: TPP Meeting #2

Name	Organization
	USACE
	USACE
	USAEC
	Fort Bliss
	Fort Bliss
	KEMRON
	Gilbane
	TCEQ
	TCEQ
	TCEQ
	EPWU
	Fort Bliss
	Fort Bliss
	Gilbane
	KEMRON
	TCEQ

The high points from the TPP meeting discussion are bulleted below.

- An overview of the digital geophysical mapping process was presented.
- Public awareness measures may include signs flyers, notices to local social media groups, and door-to-door visits.
- Screening levels as described in Worksheet #15 may warrant clarification; to be discussed after the TPP meeting.
- The stormater master plan may have helpful information regarding potential flash flooding during the field effort.
- Rights of Entry (ROEs) will be required for the property; USACE will coordinate the submittal of the ROEs.
- Old fencing/signage removal is not part of this scope. AEC will follow up with Fort Bliss to determine if those items should be removed, and if so, by whom.
- Drainage structures on the site will be checked for MEC and MC, as appropriate.
- El Paso Water Utilities may have plans for new groundwater wells. Mr. Cedillo will provide contact information for KEMRON to follow up on these plans.
- The need for a Feasibility Study will be driven by the findings of the risk assessment performed as part of the RI.

QAPP WORKSHEET #10: CONCEPTUAL SITE MODEL

The conceptual site model (CSM) is a description of a site and its environment that is based on existing knowledge. The CSM describes sources of environmental contaminants or MEC hazards at a site, actual or potential pathways, current or proposed use of the property, and potential receptors of contaminants or hazards. It provides a planning tool to integrate site information from a variety of sources, evaluate the information with respect to project objectives and data needs, and respond through an iterative process for further data collection or action. The CSM development is a process that reflects the progress of activities at a site from initial assessment through site closeout. Depending on the complexity of the investigation, typical information in the CSM includes the following.

- Facility profile that describes all man-made features at or near the site
- Physical profile to describe factors that may affect release, fate, and transport
- Land use and exposure profile to provide information used to identify and evaluate the applicable exposure scenarios and receptor locations
- Ecological profile to describe the physical relationship between developed and undeveloped portions of the site, use of the undeveloped portions, and ecological use
- Release profile relating the extent of contaminants or hazards in the environment.

A visual representation of the CSM elements related to potential contaminants, receptors, and exposure pathways is presented in **Figure 2-1**.

Facility Profile

Area and Layout:

The AOI is located in El Paso County, Texas.
Fort Bliss and El Paso, Texas, are south and east of the AOI.
The AOI is comprised of 7,936 acres that were never officially owned or used by the Army.

Boundaries:

The AOI is bordered to the south by the closed Castner Range and bounded by Martin Luther King Boulevard on the east, the Franklin Mountains State Park on the west, and Stan Roberts Sr Avenue on the north.

Structures:

A housing development exists adjacent to the AOI to the southeast, and an operating quarry is immediately north of the northern boundary.
Structures currently on site, including the "Round House", are related to ranching activities.

Utilities:

The only known electric, water, or sewer utilities present within the AOI boundaries is a gas main line. This and potential unknown underground utilities will be identified in the DGM data and avoided during intrusive operations.

Security:

No site security measures currently exist.

Physical Profile

Climate:

Days are typically warm, nights are cool, and the area is frost-free for an average of 220 days per year.

Average temperature typically varies from 32 degrees Fahrenheit (°F) to 97 °F and is rarely below 22 °F or above 104 °F. Extreme temperatures have been recorded from -8 ºF to 114 ºF.

The daily average temperature is 64 ºF, with maximum and minimum daily averages of 76 ºF and 51 ºF respectively.

Low humidity is typical in winter, and high humidity is common in summer.

Average annual precipitation is 8 inches in the valleys and 20 inches in the mountains, with most precipitation occurring during summer months.

Winds are typically light, with an average annual velocity of 10 miles per hour.

Topography:

El Paso County includes an irrigated valley along the Rio Grande; semiarid bench land east of the river (locally referred to as "the mesa"); and two small mountain ranges, the Franklin Mountains in the northwestern part of the county and Hueco Mountains in the eastern part.

The average elevation of El Paso is 3,800 feet above mean sea level (amsl).

North Franklin Mountain is the highest peak in the city, with an elevation of 7,192 feet amsl.

The average elevation at the AOI is 4,180 feet amsl.

The eastern portion of the AOI consists of flat to rolling terrain that becomes steep and mountainous toward the west.

Geology:

The AOI is located in the Basin and Range Province physiographic region, which is characterized by vast desert basins flanked by isolated, nearly parallel mountain ranges of bedrock that generally trend north or northwestward.

The valley floor, known as the Hueco Bolson, is comprised of colluvial and alluvial sediment of Quaternary age.

Caliche, lake deposits rich in salt and gypsum, and sand and gravel are the dominant sediment types in the basin area.

The formations in the area range from Precambrian to Holocene in age.

Exposed Precambrian rocks in the western portion of the AOI include nearly 5,000 feet of metamorphosed sedimentary and volcanic rocks that have been intruded by granite.

Soil:

The region includes the Agustin, Delnorte, Pintura, and Wink soil associations/complexes, all of which may be found in the AOI.

The Agustin is characterized by deep, pale-brown gravelly soils at the base of limestone and igneous mountains and on alluvial fans, generally near gravelly arroyos.

The Delnorte is characterized by shallow to very shallow hard caliche. Very gravelly soils formed over outwash material of sand and gravel. They occur on foot slopes and outwash plains of igneous and limestone mountains.

The Pintura is characterized by deep, somewhat excessively drained soils formed in coarse textured aeolian material. They are on coppice dunes on uplands with 0% to 5% slopes. The dunes have slopes of 20% to more than 80% percent.

The Wink is characterized by deep well-drained soils formed in calcareous aeolian sediment. They are on upland pediments.

Soils in valleys and basins are shallow to deep, nearly level to very steep, and well-drained to excessively drained soils.

Soil erosion varies from low to severe across the AOI.

Hydrogeology:

The AOI is underlain by the Hueco bolson aquifer, which is the principal aquifer in the El Paso area.

It consists of an upper fluvial zone of mostly stream-channel and flood-plain deposits composed of silt, sand, gravel, and caliche, and a lower lacustrine zone containing mostly clay and silt.

The maximum aquifer thickness is approximately 9,000 feet and occurs within a deep structural trough paralleling the east side of the Franklin Mountains.

Recharge is principally from precipitation percolating through alluvial deposits along the base of the Organ and Franklin mountains.

Groundwater in the valley is under leaky artesian conditions.

Water levels in the aquifer have been affected by extensive historical withdrawals, which have caused major water-level declines.

Depth to water ranges from approximately 350 feet near pumping centers to less than 100 feet elsewhere.

Hydrology:

No major source of surface water is present within the AOI.

Intermittent streams drain from the Franklin Mountains in the western portion of the site into lower lying areas to the east.

Additional intermittent streams drain rock outcrops and high elevation areas in various directions around the site.

Intermittent streams do not appear to drain to any main stream or river but rather seep through the permeable soils into groundwater or are lost to evaporation.

Vegetation:

Habitat in the AOI is predominantly Chihuahuan Desert, dominated by honey mesquite coppice dunes and sand scrub in low lying areas, and includes plants such as soaptree yucca, four-wing saltbush, broom snakeweed, grasses, and various annuals (**Photograph 2-1**).

Photograph 2-1. Vegetation within AOI North of Castner Range

Some small areas in these dunes are dominated by grasses and yucca, while other areas contain creosote bush and cactus.

Plant communities that exist in the mountains include juniper savanna, conifer and mixed woodlands, and montane conifer forests.

Wetlands:

Wetlands may be present in the form of arroyo-riparian drainages, although these habitats are not common.

Land Use and Exposure Profile

Beneficial Resources:

Franklin Mountains State Park (camping, hiking, mountain biking, ecological, cultural and historic resources)

Potable groundwater supplies

Biological resources including rare wildlife and ecosystems.

Current Land Use:

Residential housing

Light industry and commercial

Cattle grazing

Recreation, education, and wildlife preserve

Majority of the site is undeveloped.

Current Human Receptors:

Recreational (adult/child)

Residents (adult/child)

Industrial and commercial users

Franklin Mountains State Park personnel

Construction workers

Road and trail maintenance personnel

Ranchers (adult/child).

Potential Future Land Use:
There is no anticipated change in land use.

Potential Future Human Receptors:
There is no anticipated change in human receptors.

Zoning/Land Use Restrictions:
According to the El Paso City website, the following zoning areas exist in the AOI:

- G-MU – General Mixed Use District
- PMD – Planned Mountain Development District
- R-F – Ranch and Farm District

Demographics:
According to a 2015 census estimate, El Paso County has a population of 835,593, and the city of El Paso, Texas, has a population of 681,124 (http://www.census.gov/quickfacts).

Ecological Profile
Habitat Type:
Mesquite coppice dunes

Mountain habitats

Intermittent streams

Playas and natural water-collecting rock formations

Degree of Disturbance:
Extensive disturbance has occurred in select areas due to construction of roadways, commercial and residential structures, and gravel operations.

Ecological Receptors:
No federal-listed species of concern, threatened, and/or endangered species are known to be present or potentially present in the AOI.

State-listed species of concern, threatened, and/or endangered species known to be present or potentially present in the AOI include:

Six birds: northern aplomado falcon, peregrine falcon, American peregrine falcon, interior least tern, Mexican spotted owl, southwestern willow flycatcher

Two mammals: gray wolf, black bear

One plant: Sneed pincushion cactus

Three reptiles: Texas horned and mountain short-horned lizards, Chihuahuan Desert lyre snake

(http://www.tpwd.state.tx.us)

Cultural, Archaeological, and Historical Resources:

No information has been located for potential cultural, archeological, or historical resources within the AOI. Based on input from the installation, however, there is a potential for cultural resources to be located throughout the site.

Release Profile

Munitions Types

Small arms live rounds

Small arms blanks

Artillery: 75 (millimeter) mm projectiles

Release Mechanisms:

Intentional munitions firing

Simulation of war-time activities during maneuver and/or training exercises

Discarded or malfunctioned rounds.

Maximum Probable Penetration Depth:

Although not yet identified within the AOI, if firing lines and target areas are present, penetration of small arms is anticipated to be limited to near the surface.

Although 75mm MEC has not been identified within the AOI, penetration depths of 75mm projectiles in the adjacent Closed Castner Range have been recorded to 4.5 feet below ground surface (engineering-environmental Management, Inc., 2007).

MEC Density:

From the previous investigation (USACE, 2015a) no MEC has been observed within the visual survey areas. MEC density, therefore, is anticipated to be low throughout the site.

Munitions Debris:

Munitions debris (MD) may be randomly scattered across the site.

Associated Munitions Constituents:

Based on published munitions data sheets, potential MC related to 75mm projectiles identified during previous investigations include iron, sulfur, copper, lead, zinc, aluminum, potassium nitrate, and TNT.

Transport Mechanisms/Migration Routes:

There is a potential for MD and MEC to be buried as a result of wind and water erosion.

Precipitation and runoff from heavy summer monsoon storms may cause flash flooding, accelerating transport and migration of contaminants of concern (COCs).

The fate and transport of a metal in soil depends significantly on the chemical form and speciation of the metal.

Pathway Analysis:
Although not anticipated to be present, the potential for MEC on the surface or in the shallow subsurface does exist within the AOI due to past activities conducted in the adjacent Closed Castner Range or from undocumented training activities. Subsurface MEC, if present, could potentially be brought to the surface due to natural erosion processes or weather-related activities such as flooding or frost heave. The pathways for MEC are therefore considered potentially complete in the AOI.

Potential pathways for MC include soil and sediment. Insufficient sampling has occurred to determine whether MC is present in soil and sediment within the AOI. Groundwater is not considered a potential pathway for MC due to the depth to the water table. The pathways for MC are considered potentially complete in the AOI.

QAPP WORKSHEET #11A: DATA QUALITY OBJECTIVES (MEC)

Data quality objectives (DQOs) are qualitative and quantitative statements that outline the decision-making process and specify the data required to support project objectives. DQOs specify the level of uncertainty that will be accepted in results derived from data. The DQO process used for developing data quality criteria and performance specifications for decision making is consistent with the *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006). The DQO process consists of the following seven steps.

- Step 1: State the problem
- Step 2: Identify the goals of the study
- Step 3: Identify information inputs
- Step 4: Define the boundaries of the study
- Step 5: Develop the project data collection approach/Develop the Analytical Approach
- Step 6: Specify performance or acceptance criteria
- Step 7: Develop the detailed plan for obtain data

Worksheet #11A: DQO #1 – MEC Characterization

Step 1: State the Problem. There are no historical records showing ownership or use of the AOI North of Castner Range (7,936 acres) by the Army; however, multiple MD items were identified during a USACE MEC Reconnaissance Survey (USACE, 2015). The Army believes that the presence of MD is a result of overshoot during training activities conducted within the Army closed Castner Range, which borders the AOI to the south, or from kick-out debris from the open burn/open detonation (OB/OD) area within the closed Castner Range. Although no MEC was identified, the presence of MD indicates the potential for MEC to exist on the ground surface or in the shallow subsurface within the AOI North of Castner Range investigation area (5,860 acres).

Step 2: Identify the Goals of the Study. Geophysical investigation (including DGM and analog surveys) and intrusive investigation of selected subsurface anomalies within the AOI North Castner Range investigation area (5,860 acres) will be used to support the RI and will have the following goals:

- Determine and characterize the presence, nature, and extent of MEC contamination within the AOI North of Castner Range
- Prepare an FS to present remedial action alternatives by which to address the findings of the RI
- Support human health and ecological risk assessments
- Achieve stakeholder acceptance of a PP and DD to guide potential future remediation efforts.

Step 3: Identify Information Inputs. The following information inputs are required to successfully accomplish the project objectives.

- An up-to-date CSM that summarizes site conditions based on historical information and previous studies, to include the following:
    - Site history and use
    - Types and quantities of MEC known or suspected to be present
    - Expected distribution of potential MEC
    - Topography, geology, and vegetation
    - Land use considerations
    - Reasonably anticipated future uses
    - Current and future receptors
    - Exposure pathways
    - Access restrictions or other obstacles to investigation
    - Endangered species, sensitive habitats, and historic or cultural resources that could be

affected by traffic or other disturbances occurring during the investigation
    - Assumptions, data gaps, and sources of uncertainty.
- USACE Range Reconnaissance Survey results, to include the following:
    - Area surveyed
    - Description and locations of MEC/MD located
    - Photos of recovered MEC items
    - Locations of observed features potentially related to past munitions activity.
- Geophysical survey results, to include the following:
    - QC seed item information (seed description, depth, orientation, and surveyed coordinates)
    - Geophysical investigation transect locations
    - Unique subsurface anomaly identification numbers and coordinates
    - Subsurface anomaly geophysical instrument response information
    - Geophysical system daily static QC tests and QC inspection results
    - Geophysical system verification (GSV) results to include:
        - initial and daily instrument verification strip (IVS) tests
        - QC seed item detection and recovery details
- Intrusive investigation results, to include the following:
    - Results of the intrusive investigation
    - Description and locations of MEC/MD located
    - Photos of recovered MEC items
    - MEC disposal records
    - QC documentation of subsurface MEC removal operations (to include blind seed item (BSI) information and QC inspection results)

Step 4: Define the Boundaries of the Study. The lateral boundaries of the AOI North of Castner Range are displayed on **Figure 2-2**. The vertical extent of the RI extends from the ground surface to the depth of detection of the geophysical survey instrumentation used. For all detectors, the depth of detection is a function of the size, shape, wall thickness, metallic composition, orientation, and depth of the metallic object that is being detected. For the EM61 instrument that is to be used on this project, Appendix A of the Naval Research Laboratory (NRL) document, "*EM61-MK2 Responses of Standard Munitions Items*" is to be used as a guide to determine the general MEC detection depth capabilities with this instrument. Soil type and local geology can also negatively affect the depth of detection of the EM61, however, this is not expected at the AOI. The depth of detection capabilities for analog hand-held instruments are also dependent upon the criteria listed above and in general are limited to 2 ft below ground surface. Portions of the AOI that are inaccessible to the EM61 (i.e. areas where extreme terrain precludes safely conducting the geophysical investigation) will be identified and recorded during the RI.

Step 5: Develop the Data Collection Approach. Geophysical investigation transects have been designed using the proven statistical sampling tools within the Visual Sample Plan (VSP) software, coupled with historical information pertaining to the use of the AOI North of Castner Range and the adjacent closed Castner Range, and the results of the USACE MEC Reconnaissance Survey, as described in Worksheet #17. Geophysical investigations will be conducted utilizing DGM with an EM61 throughout the majority of the AOI investigation area, supplemented by analog geophysical surveys where terrain precludes the safe use of the DGM system. Intrusive investigation locations will be selected from the DGM data based on subsurface anomaly amplitude. Intrusive investigation locations for analog geophysical surveys will be selected in real-time based on hand-held metal detector response.

If subsurface anomalies with an amplitude value greater than or equal to the project detection threshold value described in Worksheet #17A and associated QC measurements that meet the measurement quality

objectives (MQO) requirements in Worksheet #22 are identified in the DGM data, **then** they will be selected as targets for further evaluation.

If the target anomaly population identified during DGM data processing and analysis is larger than anticipated, **then** a statistically representative sample of anomalies potentially representing MEC will be selected for intrusive investigation using the estimating-a-proportion statistical method at a confidence level agreed upon by the project delivery team and USACE.

If DGM subsurface anomalies are identified for intrusive investigation (either through DGM data analysis or through statistical anomaly selection based on the DGM data analysis), **then** the anomalies will be intrusively investigated in accordance with the procedures detailed in UXO SOP 4 (**Appendix H**).

If subsurface anomalies potentially related to MEC are detected during analog geophysical surveys, **then** they will be intrusively investigated in accordance with the procedures detailed in UXO SOP 3 (**Appendix H**).

If MEC or MPPEH are recovered during intrusive investigation operations, **then** specific item details will be recorded as described in Worksheet #17, and they will be identified, recorded, inspected, and disposed of in accordance with UXO SOP 5 and UXO SOP 6 (**Appendix H**).

If MEC, or MDEH, are recovered during intrusive investigation operations, **then** their presence will be considered evidence of MEC contamination and will be included in the evaluation of the nature and extent of contamination within the AOI.

Step 6: Specify Performance or Acceptance Criteria. Measurement performance criteria (MPCs) are the minimum performance specifications that the investigation design, including instruments and procedures, must meet to ensure collected data will satisfy the DQO documented in Step 1 through Step 5. The MPCs for MEC characterization are presented in Worksheet #12. Failure to achieve the MPCs may have an impact on end uses of the data. Specific MQOs and failure responses are presented in Worksheet #22.

Step 7: Develop the Detailed Plan for Obtaining Data. The MPCs established during Step 6 of the DQO process were used to develop the sample design, which is described in Worksheet #17A. The sample design is broken down into a series of specific processes and data acquisition steps, termed definable features of work (DFW).

QAPP WORKSHEET #11B: DQO #2 – MC SAMPLING

Step 1: State the Problem. The Army believes that the presence of MD is a result of overshoot during training activities conducted within the Fort Bliss closed Castner Range, which borders the AOI to the south, or from kick-out debris from the OB/OD area within the closed Castner Range. Although no MEC was identified, the presence of MD indicates the potential for MC to exist on the ground surface or in the shallow subsurface within the AOI North of Castner Range.

Step 2: Identify the Goals of the Study. IS and biased spoke-and-hub sampling will be used to support the RI and will have the following goals.

- Determine the presence, nature, and characterize the nature and extent of MC contamination within the AOI North of Castner Range above Texas residential PCLs.
- Prepare an FS to present remedial action alternatives by which to address the findings of the RI.
- Support human health risk assessments.
- Prepare a Tier I Exclusion Criteria Checklist to determine the need for a Tier II Screening Level Ecological Risk Assessment.
-
- Achieve stakeholder acceptance of a PP and DD to guide potential future remediation efforts.

Step 3: Identify Information Inputs. In addition to the inputs from DQO #1, inputs will come from intrusive investigation results of gross soil samples that will be analyzed for explosives (HMX; RDX; TNT; 2,4-dinitrotoluene [2,4-DNT]; 2,6-dinitrotoluene [2,6-DNT]; 4-amino-2,6-dinitrotoluene [4-Am-DNT]; 2-amino-4,6-dinitrotoluene [2-Am-DNT]; nitroglycerin [NG]; pentaerythritol tetranitrate [PETN]; methyl-2,4,6-trinitrophenylnitramine [tetryl]); and metals (antimony, arsenic, copper, lead, and zinc).

The IS and the spoke-and-hub sampling approaches for collecting gross soil samples will be used to obtain a reliable mean concentration of MC in the investigation zone as indicated below.

- IS of the DUs outlined in Zone 1, as presented on **Figure 2-4**, which have undergone a survey with 50-foot transect spacing. The boundaries of the DU will be determined after input from the TPP team.
- IS of the DUs outlined in Zone 2, as presented on **Figure 2-5**, which have undergone a survey with 100-foot transect spacing. The boundaries of the DU will be determined after input from the TPP team.
- IS of the DUs outlined in Zone 3, as presented on **Figure 2-6**, which have undergone a survey with 200-foot transect spacing. The boundaries of the DU will be determined after input from the TPP team.
- Spoke-and-hub sampling from the blow-in-place (BIP) locations.

The IS and the spoke-and-hub sampling approaches are described in Worksheet #17B. An example of the systematic-random IS pattern used to collect the gross soil sample within the DUs is presented on **Figure 2-7**. An example of the spoke-and-hub approach is presented on **Figure 2-8**.

Step 4: Define the Boundaries of the Study. Boundaries of the AOI North of Castner Range are the project boundaries discussed in DQO #1 and presented on **Figure 2-2**. For DUs that support human health and ecological risk assessments, the vertical boundary will be 2 feet, or directly beneath recovered MEC items.

Step 5: Develop the Analytical Approach. Sampling locations will be biased toward a "worst-case scenario." Incremental soil sampling will occur within a 1-acre DU. The sampling team will collect 50

increments per DU location. DU selection will be based on MEC finds, visual observation, geophysical surveys, ecological habitats and potential receptors, and will be biased in favor of the following areas.

- Areas with high density or frequency MEC/MD as determined by the geophysical investigation
- Berms, craters, targets, or other physical features typically associated with MEC/MD impacts or accumulations.
- Topographic features such as natural depressions, arroyos, drainages, and/or similar terrain features that represent points where MC is likely to accumulate.
- In close proximity to the residential neighborhood adjacent to the AOI or near a campsite or picnic area.

If concentrations of explosives and metals are above the action limits presented in Worksheet #15, **then** an incremental sample will be collected from 1-acre DUs adjacent to the contaminated DU to the north, south, east, and west. **If** concentrations are not detected in the surface soil or subsurface soil, **then** NFA may be warranted.

In areas where detonation has occurred, a spoke-and-hub approach to composite soil sampling will occur. Sampling at a consolidated shot location will only be conducted after the last detonation. **If** concentrations of explosives and metals are above the action limit presented in Worksheet #15, **then** identical procedures will be used to collect soil samples from 10 feet to the north, south, east, and west of the original composite location. **If** concentrations are not detected in the surface soil or subsurface soil, **then** NFA may be warranted.

Step 6: Specify Performance or Acceptance Criteria. A decision error occurs when limitations in the available data lead the decision maker to conclude that the baseline condition is false when it is true, or to conclude that the baseline condition is true when it is actually false. These two decision errors are termed false rejection error and false acceptance error, respectively. The baseline condition is that surface soil and subsurface soil of the AOI contain metals and/or explosives above the action limits in Worksheet #15.

To limit the possibility of decision errors, the planning team has focused on controlling the two contributors to decision error: sampling design error and measurement error.

Sampling Design Error
This error is influenced by sample collection design, the number of samples, and the variability of the population over space and time. The following items were considered to minimize sampling design error:

- Results of geophysical survey and
- Visual reconnaissance and the physical configuration of the area.

Measurement Error
This error is influenced by imperfections in the measurement and analysis system. To control this error the planning team has ensured that analytical measurements are undertaken under the quality systems of a DoD Environmental Laboratory Accreditation Program (ELAP) - and National Environmental Laboratory Accreditation Program (NELAP)-accredited laboratory. All samples will be collected and analyzed by adhering to the methods governed by the QA/QC requirements documented in the SOPs listed in QAPP Worksheets #21B and #23. All samples will be collected and handled as specified in the QAPP Worksheets #19 and 30; and 27.

The level of uncertainty in the dataset will be considered acceptable if the data are validated and meet the project's goals for accuracy, precision, representativeness, completeness, and comparability presented in QAPP Worksheet #12B. In addition, historical data used for decision-

making purposes need to have met the previous project objectives and be comparable to current data.

Data need to be definitive data capable of accurately characterizing the presence of chemicals of potential concern at the limit of detection (LOD) outlined in QAPP Worksheet #15.

Data Management

Laboratory analytical data will be uploaded electronically to the Environmental Data Management System (eDMS). The uploaded data will undergo automated data review (ADR). The project chemist will coordinate with the data validation chemist, field staff, and the laboratory to ensure the needed level of review will be requested. Validated laboratory data will be labeled as stage 2B validation, electronic and manual (S2BVEM) as outlined in labeling guidance document *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA, 2009). The levels of validation anticipated are listed in Worksheet #36B.

Hardcopy data reports will be delivered as pdf files either transmitted by e-mail or posted to a password-protected website. The hardcopy reports for a stage 2B data validation will be consistent with Stage 4 reporting requirements outlined in item seven of Appendix A of the DoD QSM (DoD, 2017). Item seven is the requirement for third-party review or validation. Stage 4 data will be used for data undergoing Stage 4 data validation, if required. The overall data management procedures associated with this project are described in Worksheet #34B.

Data Validation

The data validation activities that will support the required level of data quality are discussed in Worksheets #35 and #36. Screening and definitive levels of data quality are defined in Worksheet #12, Data Quality Categories. Data validation will include a review of results generated by ADR and any additional manual validation steps required to achieve the appropriate level of review. Data validation procedures will follow the decision logic outlined in the most current version of the EPA National Functional Guidelines (EPA, 2017a and EPA, 2017b). The data will be labeled in accordance with EPA's guidance document *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA, 2009).

Data validation results will be summarized in reports that will include all findings of the review and any qualifiers applied to the data. Each data validation report must be reviewed by a peer or senior reviewer before delivery to KEMRON. The validation chemist or data validator will enter all qualifier changes in the Environmental Data Management System (eDMS); the Project Chemist will approve these qualifiers in the project dataset. The validated data from the eDMS will be uploaded into the Environmental Resources Program Information Management System (ERPIMS) by KEMRON using ERPTools X.

Step 7: Develop the Detailed Plan for Obtaining Data. The sampling locations will be selected based on data from the MEC characterization and visual survey. Stakeholder input from review of field data will occur for determining the location and size of the IS sampling units. The spoke-and-hub sampling will occur at identified BIP locations.

QAPP WORKSHEET #12A: MEASUREMENT PERFORMANCE CRITERIA (MEC)

This worksheet documents project-specific measurement performance criteria (MPC) in terms of data quality indicators (DQIs; precision, accuracy, representativeness, comparability, completeness, and sensitivity [PARCCS]) for each DFW related to the RI at the AOI North of Castner Range. The activity used to assess performance relative to each MPC is also documented. The following list includes each DFW for the RI.

- Field data management
- Geographic information system (GIS) data management
- Field documentation
- Land surveying
- Vegetation removal
- IVS installation and use
- Blind seed item installation
- DGM data acquisition
- DGM data processing and analysis
- DGM target reacquisition
- Function check area (FCA) installation and use
- Anomaly avoidance
- Intrusive investigation using analog methods
- Intrusive investigation of DGM targets
- MEC and MPPEH management
- Demolition of MEC and MDEH
- Explosives management
- Exclusion zones

Failure to meet any established MPC will result in the failure of the associated dataset submittal and require rework of that dataset or additional data acquisition to meet the MPC requirements.

Worksheet 12A-1: Field Data Management

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Field Data	Accuracy Completeness	QC inspection of project database, data entry forms, digital devices, and user proficiency	Project database is established, data entry forms are developed, digital devices are in place, and user proficiency training has been performed in accordance with DATA SOP 1	Onset of field activities

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Field Documents	Accuracy Completeness	QC inspection of field documentation	Field data is generated in accordance with DATA SOP 1	Daily
Database	Accuracy Completeness	QC inspection of project database	Field data is managed in accordance with DATA SOP 1	Daily

Worksheet 12A-2: GIS Data Management

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
GIS Implementation	Accuracy Completeness	QC inspection of GIS	GIS is established	Onset of field activities
GIS	Accuracy Completeness	QC inspection of GIS	GIS data is recorded and managed in accordance with DATA SOP 2	Daily
GIS Deliverable	Accuracy Completeness	QC inspection of GIS delivery	GIS data is delivered in accordance with DATA SOP 2	Upon completion of project

Worksheet 12A-3: Field Documentation

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Field Documents	Accuracy Completeness	QC inspection of field documentation	Field data is recorded daily and is managed in accordance with FIELD SOP 1	Daily

Worksheet 12A-4: Land Surveying

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Land Surveying	Accuracy Completeness	QC inspection of land surveying data	Land surveying data is recorded and managed in accordance with FIELD SOP 2	Weekly, or as necessary
Control Monuments	Accuracy Completeness	QC inspection of installed control monuments	Control monuments are installed in accordance with FIELD SOP 2	As necessary
Boundary Markings	Accuracy Completeness	QC inspection of boundary markings	Site boundaries are marked in accordance with FIELD SOP 2	Weekly, or as necessary
Land Surveying Deliverable	Accuracy Completeness	QC inspection of Land Surveying Report	Land Surveying Report is delivered in accordance with FIELD SOP 2	Upon completion of report

Worksheet 12A-5: Vegetation Removal

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Vegetation Removal Operation	Representativeness	QC inspection of field team work methods	Work methods are performed in accordance with the FIELD SOP 3	Weekly, or as necessary

Worksheet 12A-6: IVS Installation and Use

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
IVS Installation	Precision Accuracy Sensitivity	QC inspection of geophysical system function tests	Geophysical system performance has been verified through system function checks in accordance with GEO SOP 1	Prior to IVS construction
IVS Installation	Completeness	QC inspection of IVS location	A suitable location has been selected for the IVS	Prior to IVS construction
IVS Installation	Representativeness	QC inspection of IVS background DGM survey	A background DGM survey has been conducted over the IVS location	Prior to IVS construction
IVS Installation	Completeness	QC inspection of IVS construction	The IVS is constructed using small ISOs as described in GEO SOP 1	During IVS construction
Positional	Precision Accuracy	QC inspection of IVS construction	IVS item locations are recorded with RTK-GPS	During IVS construction
DGM IVS Data	Completeness Precision Accuracy	QC inspection of initial IVS survey	The initial IVS survey is completed in accordance with GEO SOP 1	After IVS construction, prior to field data acquisition
DGM IVS Data	Precision Accuracy	Dynamic detection repeatability (IVS)	Instrument response to each IVS item will not exceed +/- 25% or +/- 2 mV (whichever is greater) of the expected baseline response (a) (for all EM61 channels)	After initial IVS survey and twice daily (am/pm) throughout DGM data acquisition operations
DGM IVS Data	Precision Accuracy	Dynamic positioning repeatability (IVS)	Position offset of IVS targets will not exceed 10 in. (25cm)	After initial IVS survey and twice daily (am/pm) throughout DGM data acquisition operations
DGM Operation	Representativeness	QC inspection of field team work methods	Work methods are performed in accordance with the GEO SOP 1	Weekly

Notes:
(a) The expected baseline mV response for the IVS item measurements is based on the average of five IVS item measurements acquired immediately after IVS construction, verified by comparison to established EM61 response values, and described in the IVS Report.

Worksheet 12A-7: Blind Seed Item Installation

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
QC Seeding	Representativeness	Review of BSI placement	Blind QC seeds are buried along investigation transects and distributed such that each DGM team can be expected to encounter at least one seed per day	Prior to DGM survey

Worksheet 12A-8: DGM Data Acquisition

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Positional	Precision Accuracy	RTK-GPS function check	RTK-GPS position checks will not exceed ± 3 inches (7.6 cm) from the established baseline position	Once daily (am)
DGM	Sensitivity	Cable Shake Test	98% of response value fluctuation due to movement of system cables will not exceed +/- 2 millivolt (mV; for all EM61 channels)	Once daily (am)
DGM	Sensitivity	Personnel Test	98% of response values fluctuation due to proximity of data collection personnel will not exceed +/- 2 mV (for all EM61 channels)	Once daily (am)
DGM	Precision Accuracy	Static Spike Test (a)	98% of response values to the standard spike test item (a small industry standard object [ISO] fixed at an orientation and distance from the sensor to provide an approximately 100-mV response on channel 2 of the EM61) will not exceed +/- 20% of the expected baseline response (b) (for all EM61 channels)	Twice daily (am/pm)
DGM	Precision Accuracy	Dynamic detection repeatability (IVS)	Instrument response to each IVS item will not exceed +/- 25% or +/- 2 mV (whichever is greater) of the expected baseline response (c) (for all EM61 channels)	Twice daily (am/pm)
DGM	Precision Accuracy	Dynamic positioning repeatability (IVS)	Position offset of IVS targets will not exceed 10 in. (25cm)	Twice daily (am/pm)
DGM	Completeness	DGM dataset	98% of along-track EM61 measurement spacing will not exceed 8 in. (20 cm)	By dataset
DGM	Completeness	DGM dataset	All accessible transects are investigated	By dataset

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
DGM Operation	Representativeness	QC inspection of field team work methods	Work methods are performed in accordance with GEO SOP 3	Weekly

Notes:
(a) The duration of data collection for the initial static background measurement is 1 minute for initial static background measurement, 1 minute for the static spike measurement, and 1 minute for final static background measurement.
(b) The expected baseline mV response for the static spike measurement is based on the average of five static spike measurements acquired the first day of DGM work, verified by comparison to established EM61 response values, and described in the IVS Report.
(c) The expected baseline mV response for the IVS item measurements is based on the average of five IVS item measurements acquired immediately after IVS construction, verified by comparison to established EM61 response values, and described in the IVS Report.

Worksheet 12A-9: DGM Data Processing and Analysis

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
DGM	Completeness	DGM Dataset	All DGM data is processed and analyzed in accordance with GEO SOP 4	By dataset
DGM	Precision Accuracy Completeness Sensitivity	Dynamic detection repeatability (QC seed items)	All QC seed items are detected	Per QC seed item
DGM	Precision Accuracy Completeness Sensitivity	Dynamic positioning repeatability (QC seed items)	90% of along-line positioning offsets of QC seed items will not exceed 18 in. (46 cm), and 100% will not exceed 24 in (61 cm)	Per QC seed item
DGM	Completeness Sensitivity	Target selection	The intrusive investigation target selection threshold is 10 mV on channel 2 of the EM61 (a detection threshold of 14.6 mV is required to detect a 75mm projectile lying horizontally at a depth of 24 in. [61 cm])	By dataset

Notes:
The 10mV target selection threshold is based on the response characteristics of a 75mm projectile. The smallest items of interest identified during the USACE reconnaissance work in the AOI North of Castner Range were 75mm projectile remnants, and no existing evidence suggests the presence of smaller munitions items in the AOI. The most likely source of smaller munitions items in the AOI, if they exist, would be kickouts from Former Castner Range demolition activities, in which case an item smaller than a 75mm projectile (a 37mm projectile, for example) would likely be on or very near the ground surface. The 10mV target selection threshold on channel 2 of the EM61 will detect a 37mm projectile in its least favorable orientation to a depth of 8 inches below ground surface.

Worksheet 12A-10: DGM Target Reacquisition

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Positional	Precision Accuracy	RTK-GPS function check	RTK-GPS position checks will not exceed ± 3 in. (7.6 cm) from the established baseline position	Once daily (am)
Positional	Completeness	Reacquisition activity	All intrusive investigation targets are reacquired	By reacquisition activity
Reac. Operation	Representativeness	QC inspection of field team work methods	Work methods are performed in accordance with the QAPP and relevant SOPs	As necessary

Worksheet 12A-11: FCA Installation and Use

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
FCA Installation	Completeness	QC inspection of FCA installation	FCA installation has been conducted in accordance with UXO SOP 1	During FCA installation
Analog instrument check	Sensitivity	Handheld metal detector function check	Handheld metal detectors are able to detect all FCA items	Once daily (am)
FCA Use	Representativeness	QC inspection of analog intrusive team use of FCA	Work methods are performed in accordance with UXO SOP 1	Weekly

Worksheet 12A-12: Anomaly Avoidance

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Analog instrument check	Sensitivity	Handheld metal detector function check	Handheld metal detectors are able to detect all IVS items	Once daily (am)
Positional	Precision Accuracy	GPS function check	GPS position checks will not exceed ± 39 inches (100 centimeters [cm]) from the established baseline position	Once daily (am)
Anomaly avoidance operations	Representativeness	QC inspection of field team work methods	Work methods are performed in accordance with UXO SOP 2	Weekly

Worksheet 12A-13: Intrusive Investigation using Analog Methods

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Analog Instrument Check	Sensitivity	Handheld metal detector function check	Handheld metal detectors are able to detect all IVS items	Once daily (am)
Positional	Precision Accuracy	GPS function check	GPS position checks will not exceed ± 39 in. (100 cm) from the established baseline position	Once daily (am)
Intrusive Operations	Completeness	QC inspection of intrusive investigation operation	All transects are investigated	By transect
Intrusive Operations	Representativeness	QC inspection of field team work methods	Work methods are performed in accordance with the QAPP and relevant SOPs	Weekly
Intrusive Operations	Representativeness Completeness	QC inspection of intrusive investigation locations in accordance with EM 200-1-15, Table 6-6	Intrusive investigation targets have been removed and no subsurface anomalies greater than the target detection threshold exist at the investigation locations	By analog investigation lot (approximately 8,700 linear feet of transect)
Intrusive Operations	Precision Accuracy Completeness Sensitivity	QC seed item recovery	All QC seed items are recovered	Per QC seed item

Worksheet 12A-14: Intrusive Investigation of DGM Targets

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Analog Instrument Check	Sensitivity	Handheld metal detector function check	Handheld metal detectors are able to detect all IVS items	Once daily (am)
DGM QC Test	Sensitivity	Cable Shake Test (EM61)	Response value fluctuation due to movement of system cables will not exceed +/- 2 mV	Once daily (am)
DGM QC Test	Sensitivity	Personnel Test (EM61)	Response value fluctuation due to proximity of data collection personnel will not exceed +/- 2 mV	Once daily (am)
DGM QC Test	Precision Accuracy	Static Spike Test (a) (EM61)	Response value to the standard spike test item (a small ISO fixed at an orientation and distance from the sensor to provide an approximately 100-mV response on channel 2 of the EM61) will not exceed +/- 10% of the expected baseline response (b)	Twice daily (am/pm)

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Positional	Precision Accuracy	RTK-GPS function check	RTK-GPS position checks will not exceed ± 3 in. (7.6 cm) from the established baseline position	Once daily (am)
Intrusive Operations	Completeness	Intrusive investigation list	All targets identified for intrusive investigation have been investigated	By intrusive investigation target list
Intrusive Operations	Representativeness	QC inspection of field team work methods	Work methods are performed in accordance with the QAPP and relevant SOPs	Weekly
Intrusive Operations	Representativeness Completeness	QC inspection of intrusive investigation locations in accordance with EM 200-1-15, Table 6-6	Intrusive investigation targets have been removed and no subsurface anomalies greater than the target detection threshold exist at the investigation locations	By DGM investigation lot (approximately 15,000 linear feet of transect)
Intrusive Operations	Precision Accuracy Completeness Sensitivity	QC seed item recovery	All QC seed items are recovered	Per QC seed item

Notes:
(a) The duration of data collection for the initial static background measurement is 1 minute for initial static background measurement, 1 minute for the static spike measurement, and 1 minute for final static background measurement.
(b) The expected baseline mV response for the static spike measurement is based on the average of all static spike measurements during the first four days (or first week).

Worksheet 12A-15: MEC and MPPEH Management

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Field documentation	Accuracy Completeness	Intrusive investigation field documentation	All MEC and MPPEH items are properly inspected and certified in accordance with UXO SOP 5	Per MEC/MPPEH item
Field documentation	Accuracy Completeness	Intrusive investigation field documentation	Documentation for all MEC/MPPEH items is completed in accordance with UXO SOP 5	Per MEC/MPPEH item
MEC and MPPEH management operations	Representativeness	QC inspection of field team work methods	Work methods are performed in accordance with UXO SOP 5 Materials are correctly segregated and identified as MEC, MDEH, or MDAS MDAS is properly certified MDAS is secured in lockable containers with serialized locks	Weekly

Worksheet 12A-16: Demolition of MEC and MPPEH

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Demolition operations	Representativeness	QC inspection of field team work methods	Work methods are performed in accordance with UXO SOP 6	Per event or as necessary
MEC disposal documentation	Accuracy Completeness	QC inspection of field team work methods and review of MEC disposal documentation	MEC/MDEH items are transported using appropriate procedures and precautions Chain-of-custody procedures are followed.	Per event or as necessary
Demolition operations	Accuracy	Demolition Supervisor verification of proper positioning of explosives for disposal	Donor explosives are placed correctly for the type of munition(s) being destroyed Demolition operations are performed in accordance with DDESB-approved ESP and USACE disposal manuals	Per event
Demolition operations	Completeness	SUXOS verification of demolition operation	All explosive materials placed in a demolition shot are consumed by the explosion with no kick-outs, including complete destruction of MEC/MPPEH items	Per event
MEC disposal documentation	Accuracy Completeness	Review of MEC disposal documentation	All required disposal documentation is complete	Per event

Worksheet 12A-17: Explosives Management

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Explosives Management documentation	Accuracy Completeness	Review of explosives management documentation	All required explosives management documentation is complete	Onset of field activities and as necessary

Worksheet 12A-18: Exclusion Zones

Data Type	DQI	QC Sample or Measurement Performance Activity	MPC	Frequency
Exclusion Zone designation	Accuracy Completeness	QC review of exclusion zone establishment	Exclusion zones are established in accordance with UXO SOP 8 and appropriate notifications are made. Exclusion zones are based on the current DDESB TP-16 Fragmentation Data Review Form for the munitions encountered.	As necessary

QAPP WORKSHEET #12B: MEASUREMENT PERFORMANCE CRITERIA (MC)

MPC for field QC sampling results are used to evaluate project DQIs in terms PARCCS. The MPCs will be used to determine data usability in terms of being able to use the results to compare to the action limits presented in Worksheet #15 and to identify sources of error. In addition, the analytical acceptance criteria presented in Worksheet #12 tables are linked to the data validation protocols presented in SOP PR-TC-04010000. Each project laboratory is required to ensure compliance with method and SOP requirements regardless of the level of data validation that will be performed on the resulting data. If a QC element does not meet control criteria, the appropriate qualifier will be applied to all associated results. The overall impact of QC discrepancies, including data gaps resulting from rejected data points, will be assessed in accordance with QAPP Worksheet #37.

The definition and the formulas used to calculate the PARCCS parameters are described below. Field sample frequency is based guidance found in the DoD Environmental Field Sampling Handbook (DoD, 2013a). Field QC samples will be collected at a frequency of 10% for this project.

Data Quality Indicators: PARCCS
The PARCCS parameters will be used to help identify deficiencies in the sample data that would affect achieving the project DQOs.

Precision
Precision is defined as the degree of mutual agreement between individual measurements of the same property under similar conditions and provides a measurement of the reproducibility of an analytical result. Precision will be evaluated through the analysis of laboratory replicates (LRs), field duplicates (FD), field triplicates, laboratory control samples (LCSs), and matrix spikes (MSs). FD and/or triplicate samples will be collected at a frequency of one per 10 field samples of a given matrix.

The equation needed to calculate the relative percent difference (RPD) or variance for duplicate samples is presented below. For MS/MSD samples the combined field and laboratory variance is evaluated; and for LCS/LCSD samples the laboratory variance is evaluated. The variance between the samples, in terms of RPD, is calculated according to the following equation.

$$RPD = \frac{|A - B|}{(A + B)/2} \quad x \quad 100\%$$

where: A = First duplicate concentration
B = Second duplicate concentration

The equation needed to calculate the relative standard deviation (RSD) for triplicate samples is presented below. For triplicate the sampling uncertainty is defined in terms of RSD. An average concentration is used in determining the uncertainty. The average is calculated by summing the individual results and dividing this sum by the number of individual values, according to the following equation.

$$\bar{x} = \frac{x_1 + x_2 + x_3}{n}$$

The standard deviation is calculated to show how precise the average is and is a measure of random error. It is calculated according to the following equation.

$$SD = \frac{\sqrt{(x_1-\bar{x})^2 + (x_2-\bar{x})^2 + (x_3-\bar{x})^2}}{n-1}$$

The random error of sampling is expressed in percent as the relative standard deviation obtained by multiplying the standard deviation by 100 and dividing by the average concentration according to the following equation.

$$RSD = 100SD/\bar{x}$$

For the equations above:

x = a replicate concentration
n = number of replicates taken
SD = standard deviation

Field Triplicate Sample

A field triplicate samples are comprised of three samples collected in the same decision unit. Triplicate sample results will be used to assess total precision and variability associated with the sample collection process and the laboratory analysis. Triplicate samples will be collected in a systematic-random pattern within the decision unit and will be treated identically during transportation, preparation and analysis. Field triplicates will be collected at a frequency of 10% for this project.

Laboratory Replicate

Laboratory replicates are repeated - but independent - analyses of the same sample, at essentially the same time, and under the same conditions. The sample is split in the laboratory, and each fraction is carried through all stages of sample preparation and analysis. Replicate analyses are used to assess the precision of each analytical method. Laboratory replicate analysis generally is performed for those methods for which spiked duplicate samples cannot be used. Laboratory replicates provide limited or no information if all or most analytes are not detected in the sample selected for duplication. The required frequency will be one LR per analytical or preparation batch (up to 20 samples), or one for every 20 samples, whichever is more frequent.

LCS/LCSD and/or Triplicates

LCSs are aliquots of reagent water or Ottawa sand prepared and spiked by the laboratory with method analytes at a specified concentration, usually in the mid-calibration range. LCSs are carried through the entire sample preparation and analysis process, and are used to demonstrate that the method or instrument is operating within acceptable accuracy and precision limits. LCSs will be required for all analytical methods (where possible and applicable) at a frequency of one LCS per preparation batch and one per analytical batch. The laboratory may choose to prepare and analyze an LCSD and/or triplicate LCS in addition to an LCS at no expense to KEMRON. If the LCSs are prepared and analyzed, then all of the LCSs must meet accuracy tolerances for all analytes specified. If a duplicate or triplicate are analyzed, data qualifier (DQ) flags will be applied to the entire batch of samples based on the laboratory QC precision that is out of control.

MS/MSD

An MS is a solution of known concentrations of selected target analytes that will be added to a field sample aliquot before sample preparation and analysis. An additional aliquot of the sample will be prepared and spiked by the laboratory to create an MSD. The RPD between the duplicate spikes will be used to assess the precision of the method for the specific sample matrix. At least

one sample MS/MSD pair for each method will be submitted to the laboratory for MS/MSD preparation and analysis so that site-specific matrix effects can be identified.

The frequency of MS/MSD preparation and analysis in the laboratory will be one pair per 20 samples or one pair per preparation batch for methods requiring a preparation, and one pair per analytical batch for methods not requiring preparation, whichever is more frequent, for each matrix. MS/MSD QC criteria do not apply if the native concentration of the target analyte is greater than four times the spike concentration. DQ flags will be applied to the only to the parent samples based on the MS precision that is out of control.

Accuracy

Accuracy is the degree of agreement between an analytical measurement and a reference accepted as a true value. The accuracy of a measurement system can be affected by errors introduced by field contamination, sample preservation, sample handling, sample preparation, or analytical techniques. A program of sample spiking will be conducted to evaluate laboratory accuracy. Accuracy will be evaluated by the percent recovery of the spiked compounds in the LCS, MS, and surrogates. LCS, MS, and surrogates will be spiked prior to extraction. LCS and MS samples will be spiked with the method target compounds and surrogates will be added to every sample and spike. MS and LCS or blank spike samples will be analyzed at a frequency of 5% or one per sample delivery group/analytical batch (sample sets can be up to 20 field samples). The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy, using the following equation:

$$\text{Percent Recovery} = \frac{S - C}{T} \times 100$$

where: S = Measured spike sample concentration
C = Sample concentration
T = True or actual concentration of the spike

LCS/LCSD and/or Triplicate

If the LCS/LCSD pair or triplicate are prepared and analyzed, then all of the LCSs must meet accuracy tolerances for all analytes specified. If an LCS/LCSD and/or triplicate is analyzed, data qualifier (DQ) flags will be applied to the entire batch of samples based on the laboratory QC accuracy that is out of control.

MS/MSD

The percent recovery of each spiked compound is used to assess bias caused by matrix interferences. DQ flags will be applied to the only to the parent samples based on the MS accuracy that is out of control.

Surrogates

Surrogates are organic compounds similar to the target analyte(s) in structure and chemical behavior in the analytical process, but that are not normally detected in environmental samples. The surrogate results are used to evaluate accuracy, method performance, and extraction efficiency. These surrogate compounds are spiked in environmental samples, control samples, and blank samples per the method requirements. The surrogate should be spiked at a concentration less than or equal to the midpoint of the linear range calibrated.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize cross-contamination. Representativeness will also be assessed using field and laboratory blank samples.

A method blank will be analyzed with every analytical or preparation batch (as appropriate to the analytical method) to determine potential contamination introduced during routine laboratory procedures. Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) will be analyzed as required by analytical methods. Equipment blanks will be collected to assess potential contamination due to field conditions. The assessment of blank samples will determine if compounds detected in the environmental samples are site related or have been introduced through field procedures or laboratory procedures.

Project design (see Worksheet #17B) is one of the critical inputs that determine if the data collected is representative of the population sampled. Historical data and field surveys will help ensure that a representative dataset has been collected to adequately characterize the area. In addition, representativeness of individual samples will be controlled by sample collection and handling in accordance with the requirements of Worksheet #19 &30 and #26 & 27 and the SOPs presented in **Appendix H**. The sample containers and preservation methods presented in Worksheet #19 & 30 will be used to ensure that samples arriving at the laboratory retain the appropriate degree of representativeness. The holding times presented in Worksheet #19 & 30 have been established to ensure that samples retain representativeness at the time of extraction and analysis.

Method Blanks

A method or preparation blank is a sample composed of the laboratory reagent in the same quantity used to prepare a sample for analysis. The method blank undergoes the same sample preparation procedure as a field sample. Method blanks ensure that interferences from the analytical system, reagents, and glassware are under control. The required frequency for analysis of method blanks will be one per day for each method/instrument and/or one per preparation or analytical batch (up to 20 samples), as specified in the method.

Equipment Blanks

Equipment blanks will be used to assess the thoroughness of the field decontamination procedures of non-disposable equipment. Equipment blanks will be collected using deionized water that will be proven by the laboratory to be free of contaminants of concern prior to use. The water will be poured through a decontaminated sampling device, collected in the appropriate sample container, and transported to the laboratory for analysis. It is expected that disposable equipment will be used for this project. However, if non-dedicated equipment is used, one equipment blank per day will be collected for each type of applicable equipment.

Grinding Blanks

A grinding blank consisting of clean solid matrix (such as Ottawa sand) must be prepared (e.g., ground and subsampled) and analyzed in the same manner as a field sample. Grinding blanks can be analyzed individually or composited. Grinding blanks must be processed and analyzed to ensure cross-contamination is not occurring between samples.

Temperature Blanks

A temperature blank is a container of water that is packed and shipped to the laboratory with the field samples requiring preservation by cooling to < 6 degrees Celsius (°C). Upon arrival of the samples, the laboratory measures the temperature of the blank.

Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with the procedures outlined in this QAPP and when none of the QC criteria used to determine the usability of the data is critically exceeded to the point of rejection.

Completeness will be evaluated by reviewing the tasks that contribute to the sampling event, such as sampling handling and storage procedures, COC procedures, analytical procedures, and data-validation procedures. The project team may determine that individual sampling points or areas are more critical than others for decision making. Any sampling locations identified as such will have a completeness goal of 95% as determined by the validation process. The completeness goal for this project that still allows for attaining the project objectives is 90%.

$$\frac{\text{Number of possible analyte results} - \text{Number of rejected and unreported results}}{\text{Possible number of analyte results}} \times 100$$

Comparability

Comparability expresses the confidence with which one dataset can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures outlined in SOPs and published methods. In addition a standard unit of measurement will be used in reporting analytical and field data. Analytical and field methods selected for this investigation are consistent with the methods used during previous investigations of this type.

Sensitivity

The detection limit (DL), LOD, and limit of quantitation (LOQ) will be evaluated by the project team prior to sample analysis to determine if the laboratory is able to attain the required sensitivity for the project. The DL is the minimum quantity of an analyte that can be reliably distinguished from background noise or from zero for a specific analytical method at a 99% confidence level. The DL protects against false positives. The LOD is the minimum quantity of an analyte that can be reliably detected for a specific analytical method at a 99% confidence level that the value is not a false negative. The LOD should be equivalent to the concentration of the DL verification standard. The LOQ represents the smallest quantity of an analyte that can be accurately and reproducibly quantified in a given sample matrix (e.g., three to five times the LOD).

The LOD and/or the LOQ should be sensitive enough to meet the PALs (e.g., cleanup goals). The LOD will be used to determine if no detectable amounts of contaminants of concern are present. The DL will be used to report concentrations as detected results. Results reported as detections with quantitation below the corresponding LOQ and above the corresponding DL, will be reported by the laboratory with the qualification of "J" to indicate that the result is considered an estimate as a result of being quantitatively below the calibrated range but qualitatively identifiable. Non-detected results will be reported by the laboratory as non-detect at the LOD. For non-detect duplicate or triplicate results, the data will be assessed at the LOD with the LOD value used in the appropriate calculation.

As available, the measurement performance criteria are taken from Appendix B and Appendix C of the QSM (DoD, 2017). Laboratory limits have been reviewed and are provided in **Appendix G**.

Worksheet 12B-1: Explosives (Soil)

Method: EPA 8330B
Matrix: Soil (mg/kg)
Concentration Level: Unknown

Data Quality Indicators (DQIs)	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria[1]	
Overall Precision	Field Triplicates[2]	RSD[3] < 20%	
Analytical Precision (matrix interference)	Laboratory Replicate[4]	RPD[3] < 20%	
Precision (laboratory)	Confirmation Analysis	RPD[3] <40	
Accuracy	Surrogate	1,2-Dinitrobenzene	83-119
Analytical Accuracy (laboratory)	Laboratory Control Sample (LCS)	Tetryl	68-135
		2,4,6-Trinitrotoluene	71-120
		Nitroglycerin	73-124
		RDX	67-129
		PETN	72-128
		HMX	74-124
		2,6-Dinitrotoluene	79-117
		4-Am-DNT	64-127
		2-Am-DNT	71-123
		2,4-Dinitrotoluene	75-121
Analytical Accuracy/Bias (laboratory)	LCSD/Triplicate LCS[4]	RPD[3] < 20% RSD[3] < 20%	
Analytical Accuracy (matrix interference)	Matrix Spike (MS)[4]	LCS limits listed above	
Analytical Accuracy/Bias (matrix interference)	Matrix Spike Duplicate (MSD)[4]	RPD[3] < 20%	
Bias/Sensitivity	Method Blanks	< ½ LOQ[5]	
Overall Accuracy/Bias	Equipment Rinsate Blanks	< ½ LOQ[5]	
Laboratory Bias	Soil Grinding Blanks	< ½ LOQ[5]	
Laboratory Bias	Air Drying of Samples	Constant Weight	
Completeness	Data Assessment	≥ 90%	
Comparability	Data Review: compare results to previous sampling events.	Similar units and LOQs meet PALs[5]	

Notes:
See Worksheet #21 for sampling procedure list.
[1]MPC from Appendix C, Table C-37 and Appendix B, and Table B-3 DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 5_1 (DoD, 2017)
[2]Only the field duplicate or triplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these criteria.
[3]Relative percent difference (RPD) and relative standard deviation (RSD) will be calculated for all detected results.
[4]Precision can be determined from the sample duplicate, triplicate, MS/MSD, LCS/LCSD and laboratory replicate.
[5]See Worksheet 15 for LOQs and project action limits (PALs).

Worksheet 12B-2: Explosives (Water)

Method: EPA 8330B
Matrix: Water
Concentration Level: Unknown

Data Quality Indicators (DQIs)	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria[1]	
Analytical Precision (matrix interference)	Laboratory Replicate[2]	RPD[3] < 20%	
Precision (laboratory)	Confirmation Analysis	RPD[3] <40	
Accuracy	Surrogate	1,2-Dinitrobenzene	83-119
Analytical Accuracy (laboratory)	LCS	Tetryl	64-128
		2,4,6-Trinitrotoluene	71-123
		Nitroglycerin	74-127
		RDX	68-130
		PETN	73-127
		HMX	65-135
		2,6-Dinitrotoluene	77-127
		4-Am-DNT	76-125
		2-Am-DNT	79-120
		2,4-Dinitrotoluene	78-120
Analytical Accuracy/Bias (laboratory)	LCSD[2]	RPD[3] < 20%	
Analytical Accuracy (matrix interference)	MS[2]	LCS limits listed above	
Analytical Accuracy/Bias (matrix interference)	MSD[2]	RPD[3] < 20%	
Bias/Sensitivity	Method Blanks	< ½ LOQ[4]	
Overall Accuracy/Bias	Equipment Rinsate Blanks	< ½ LOQ[4]	
Completeness	Data Assessment	≥ 90%	
Comparability	Data Review: compare results to previous sampling events.	Similar units and LOQs meet PALs[4]	

Notes:
See Worksheet #21 for sampling procedure list.
[1]QC limits from Appendix C, Table C-37 and Appendix B, and Table B-,3 DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 5_1 (DoD, 2017)
[2]Precision can be determined from the laboratory replicate, MS/MSD and LCS/LCSD.
[3]RPD will be calculated for all detected results.
[4]See Worksheet 15 for LOQs and PALs.

Worksheet 12B-3: Metals (Soil)

Methods: EPA 6010C - ICP-AES Metals
Matrix: Soil
Concentration Level: Unknown

Data Quality Indicators (DQIs)	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria[1]		
Precision	Field Duplicates[2]	RPD[3] ≤20%		
Precision	Laboratory Duplicates[4]	RPD[3]≤ 20%		
Precision	QA Splits	NA		
Accuracy	Matrix Spike (MS)	LCS Limits Listed Below		
Accuracy	LCS	**Metal**	**Soil**	**Water**
		Antimony	79-114	88-113
		Arsenic	82-111	87-113
		Copper	81-117	86-114
		Lead	81-112	86-113
		Zinc	82-113	87-115
Analytical Accuracy/Bias (laboratory)	LCSD[2]	RPD[3] < 20%		
Analytical Accuracy/Bias (matrix interference)	MSD[2]	RPD[3] < 20%		
Bias/Sensitivity	Method Blanks	< ½ LOQ[5]		
Field Bias	Rinsate Blanks	< ½ LOQ[5]		
Completeness	Data Assessment	≥ 90%		
Comparability	Data Review: compare results to previous sampling events.	Similar units and LOQs meet PDLs[5]		

Notes:
See Worksheet #21 for sampling procedure list.
[1]QC limits from Appendix C, Tables C-3and C-4; and Appendix B Table B-8, DoD QSM, Version 5_1 (DoD, 2017)
[2]Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these criteria.
[3]RPD will be calculated for all detected results
[4]Precision will be determined from the LCS/LCSD, MS/MSD or sample and sample duplicate.
[5]See Worksheet 15 for LOQs and PALs.

Worksheet 12B-4: Metals (Water)

Methods: EPA 6020A - ICP-MS Metals
Matrix: Water
Concentration Level: Unknown

Data Quality Indicators (DQIs)	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria[1]		
Precision	Field Duplicates[2]	RPD[3]≤20%		
Precision	Laboratory Duplicates[4]	RPD[3]≤ 20%		
Precision	QA Splits	NA		
Accuracy	Matrix Spike (MS)	LCS Limits Listed Below		
Accuracy	LCS[5]	**Metal**	**Soil**	**Water**
		Antimony	72-124	85-117
		Arsenic	82-118	84-116
		Copper	84-119	85-118
		Lead	84-118	88-115
		Zinc	82-119	83-119
Analytical Accuracy/Bias (laboratory)	LCSD[2]	RPD[3] < 20%		
Analytical Accuracy (matrix interference)	MSD[2]	LCS limits listed above		
Bias/Sensitivity	Method Blanks	< ½ LOQ[6]		
Field Bias	Rinsate Blanks	< ½ LOQ[6]		
Completeness	Data Assessment	≥ 90%		
Comparability	Data Review: compare results to previous sampling events.	Similar units and LOQs meet PDLs[5]		

Notes:
See Worksheet #21 for sampling procedure list.
[1]QC limits from Appendix C, Tables C-5and C-6; and Appendix B Table B-9, DoD QSM, Version 5_1 (DoD, 2017)
[2]Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these criteria.
[3]RPD will be calculated for all detected results
[4]Precision will be determined from the LCS/LCSD, MS/MSD or sample and sample duplicate.
[5]See Worksheet 15 for LOQs and PALs.

QAPP WORKSHEET #13: SECONDARY DATA USES AND LIMITATIONS

Secondary Data	**Data Source** (originating organization, report title and date)	**Data Generator(s)** (data types, data generation/ collection dates)	**How Data Will Be Used**	**Limitations on Data Use**
Report	USACE, *MEC Reconnaissance Survey Report, Former North Castner Range, El Paso, TX*, June 2015a	Data collection: 06/10-12/2013 and 02/16-19/2015	Investigation planning	None
GIS	U.S. Army / USACE	Data type: spatial (topographical, vegetation, and historical ranges)	GIS	External usage requires Fort Bliss/USACE approval

QAPP WORKSHEET #14 & 16: PROJECT TASKS AND SCHEDULE

Activity	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date	Associated SOP(s) and/or Guidance (Appendix H)
Field Tasks					
Daily safety meetings - review daily activities and ensure on-site team is familiar with safety requirements and concerns. Ensure field teams are adequately prepared with respect to equipment, training, anticipated hazards, weather, COCs, and other environmental concerns.	February 2018	April 2018	RI/FS Report	N/A	PR-TC-01040100 PR-TC-01040500 PR-TC-01040400 PR-TC-02040101
Location surveys, visual surveys, and geophysical mapping	February 2018	April 2018	RI/FS Report	N/A	DATA SOP 1 DATA SOP 2 FIELD SOP 2 UXO SOP 1 UXO SOP 2 GEO SOP 1 GEO SOP 2 GEO SOP 3 GEO SOP 4 GEO SOP 6
Target reacquisition, intrusive investigation, and MEC characterization/identification	March 2018	April 2018			DATA SOP 1 DATA SOP 2 UXO SOP 1 UXO SOP 3 GEO SOP 5 UXO SOP 4 UXO SOP 5 UXO SOP 6 UXO SOP 7 UXO SOP 8 UXO SOP 9
Soil sampling - Conduct soil sample collection for laboratory analysis.	March 2018	April 2018			PR-TC-02020101 PR-TC-02020102 PR-TC-02020106

Activity	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date	Associated SOP(s) and/or Guidance (Appendix H)
Activity	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date	Associated SOP(s) and/or Guidance (Appendix H)
Laboratory Tasks					
Analytical lab analysis of soil samples to support determination of presence or absence or extent of soils contamination.	April 2018	April 2018	Laboratory Report	May 2018	See Worksheet #21B
Office Tasks					
Prepare project plans – Project Management Plan, Quality Assurance Surveillance Plan, Work Plan, SSHP, Accident Prevention Plan, Site Safety and Health Plan, Explosives Site Plan, Community Relations Plan,	November 2016	February 2018	Final Plans	February 2018	
Historical Records Search	January 2017	July 2017	Historical Records Report	July 2017	
Conceptual Site Model	July 2018	October 2018	Final Plans	January 2019	
Data validation of analytical results	July 2018	August 2018	RI/FS Report	July 2018	PR-TC-04010000
Prepare formal project reports	May 2018	May 2020	RI/FS Report, Decision Document Preparation, Administrative Record	May 2020	
Perform professional analysis of site investigations	October 2018	May 2019	Updated CSM	August 2019	
Provide ERPIMS	June 2018	September 2018	Accepted ERPIMs deliverable	November 2018	

QAPP WORKSHEET #15: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

The objective of this worksheet is to present the screening level hierarchy that will be used to evaluate the data collected. Worksheet #15 is applicable only to DQO #2 (MC Sampling).

The screening levels presented in the tables are chemical-specific concentrations for individual contaminants above which further investigation or cleanup may be warranted. The methods presented to attain the selected screening levels are all standard EPA methods and are listed in the laboratory accreditation tables of **Appendix G**. Worksheet #23 presents the preparation and analytical method references table along with the laboratory SOPs that will be used in analyzing the samples method.

The laboratory sensitivity levels in the form of the LOQ and LOD are presented for review. Non-detects will be reported to the LOD to protect against false negatives. Detections will be reported to the calculated detection limit (DL) to achieve the lowest possible sensitivity for the compounds. The laboratory sensitivity limits are included in **Appendix G**.

QAPP Worksheet No. 15.1 Explosives in Soil by Methods 8330B

Analyte	CAS Number	30-Arce Source Area PCLs[1]		Residential Screening Level[2]	Industrial Screening Level[3]	Action Limit	Laboratory Sensitivity Limits	
		Soil combined	Soil Ingestion				LOD	LOQ
Units	--	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
HMX	2691-41-0	1,600	1.2	3,900	57,000	1.2	0.040	0.100
RDX	121-82-4	43	0.018	6.1	28	0.018	0.100	0.200
TNT	118-96-7	33	0.086	21	96	0.086	0.100	0.100
4-Am-DNT	19406-51-0	11	0.033	150	2,300	0.033	0.100	0.100
2-Am-DNT	35572-78-2	11	0.05	150	2,300	0.05	0.100	0.100
2,4-DNT	121-14-2	6.9	0.0027	1.7	7.4	0.0027	0.040	0.100
2,6-DNT	606-20-2	6.9	0.0024	0.360	1.5	0.0024	0.040	0.100
NG	55-63-0	6.7	0.0069	6.3	82	0.0069	0.400	2
PETN	78-11-5	130	6.2	130	570	6.2	1	2
Tetryl	479-45-8	150	0.28	160	2,300	0.28	0.100	0.200

QAPP Worksheet No. 15.2 Metals in Soil by Methods 6010C

Analyte	CAS Number	30-Arce Source Area PCLs[1]		Residential Screening Level[2]	Industrial Screening Level[3]	Background Data[4]	Action Limit	Laboratory Sensitivity Limits	
		Soil combined	Soil Ingestion					LOD	LOQ
Units	--	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Antimony	7440-36-0	15	2.7	31	470	0.2	2.7	1.5	2
Arsenic	7440-38-2	24	2.5	0.68	3	2.9	2.9	2.5	2.5
Copper	7440-50-8	1,300	520	3,100	47,000	13	520	0.8	5.0
Lead	7439-92-1	500	20.8	400	800	20.8	1.5	0.8	0.9
Zinc	7440-66-6	9,900	1,200	23,000	350,000	35	1,200	1.5	8.0

QAPP Worksheet No. 15.3 Metals in Soil by Methods 6020A

Analyte	CAS Number	30-Arce Source Area PCLs[1]		Residential Screening Level[2]	Industrial Screening Level[3]	Background Data[4]	Action Limit	Laboratory Sensitivity Limits	
		Soil combined	Soil Ingestion					LOD	LOQ
Units	--	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Antimony	7440-36-0	15	2.7	31	470	0.2	2.7	0.1	0.2
Arsenic	7440-38-2	24	2.5	0.68	3	2.9	2.9	0.2	0.6

Notes:
[1]Texas Risk Reduction Program Protective Concentration Levels (Texas Commission on Environmental Quality, 2017)
[2]Regional Screening Summary Table, May 2016 (EPA, 2016)
[3]Regional Screening Summary Table, May 2016 (EPA, 2016)
[4]Background Data from the Southern Area, Table 4-6 (URS, 2013)
mg/kg = milligram per kilogram

QAPP WORKSHEET #17A: SAMPLING DESIGN AND RATIONALE (MEC)

The purpose of the RI that is to be conducted at the AOI North of Castner Range is to characterize the nature and extent of potential MEC and MC contamination within the AOI. The RI will be followed by an FS that will present alternatives by which to address the findings of the RI. A PP and DD will then be generated that will be used as a guide for potential future remediation efforts. The RI is comprised of investigations for MEC and for MC, the latter of which will be based in part on the results of the former.

The sampling design and rational for the MEC portion of the RI that is to be conducted in the AOI North of Castner Range is based on the following information:

- Historical information pertaining to the use of the AOI North of Castner Range and the adjacent closed Castner Range; and
- Results of the USACE MEC Reconnaissance Survey.

Using this information, KEMRON has used the proven statistical sampling tools within the VSP software to design a transect-based RI survey approach. The accessible portion of the AOI (i.e. areas with less than 30% slopes [approximately 5,860 acres]) has been divided into three distinct transect sampling zones. These three distinct sampling zones are based on their location with respect to the former OB/OD range and previous investigation findings (**Figure 2-3**).

The first sampling investigation zone (Zone 1) is located in the southeastern portion of the AOI that lie within the estimated kick-out area of the former OB/OD range that was part of the closed Castner Range, as shown on **Figure 2-4**. Based on the results of previous remediation work conducted in the closed Castner Range, it is anticipated that that this is the area of the AOI most likely to contain MEC items from previous demolition activities. The RI survey in Zone 1 will be conducted along transects spaced at 50-foot intervals within the estimated OB/OD kick-out area (approximately 6% coverage of the investigation zone). At this transect spacing, VSP calculations predict a 100% probability of traversing a 25-foot radius area where elevated concentrations of metallic debris may be related to the potential presence of MEC.

The second sampling investigation zone (Zone 2) will focus on detecting areas of high metallic debris concentration in the remainder of the AOI that are potentially related to the presence of MEC from overshoot during training activities at the closed Castner Range. Zone 2 consists of two sub areas that were recommended for further investigation after munitions or munitions related debris had been identified in those areas. This second investigation zone, shown on **Figure 2-5**, includes the areas of the AOI designated for further investigation as a result of the MEC Reconnaissance Survey, other than the portion included in the OB/OD kick-out area (Zone 1). The RI survey in Zone 2 will be conducted along transects spaced at 100-foot intervals (approximately 3% coverage of the investigation zone). At this transect spacing, VSP calculations predict a 100% probability of traversing a 50-foot radius area where elevated concentrations of metallic debris may be related to the potential presence of MEC.

The third sampling investigation zone (Zone 3), shown on **Figure 2-6**, includes those portions of the AOI in which USACE found no evidence of munitions contamination during the MEC Reconnaissance Survey, other than the portion included in Zone 1 and 2. Based on the USACE findings, MEC and MC are not anticipated to be present in Zone 3. The RI survey that is to be conducted in Zone 3 will be conducted along transects spaced at 200-foot intervals (approximately 1.5% coverage of the investigation zone) to provide additional information to support a potential decision of No Further Action (NFA). Military target and overshoot areas generally have a radius of at least 100 feet due to inaccuracies in firing and fragmentation of training munitions. VSP calculations predict a 100% probability of traversing a 100-foot radius area using transects spaced at 200-foot intervals.

Up to 10 additional acres of investigation may be conducted in areas of elevated anomaly density identified during the initial transect survey to refine the nature and extent of MEC. This additional investigation may be conducted along more closely spaced transects or using grids with comprehensive coverage, depending on the specific characteristics of the area. This additional investigation data will provide higher-resolution information in the areas where the greatest concentrations of subsurface anomalies may indicate an increased likelihood of the presence of subsurface MEC items.

If MEC items are recovered within areas of elevated geophysical anomaly density that extend to or beyond the AOI boundary, a step-out investigation process will be implemented to bound the areas of potential munitions use. The step-out process will involve additional geophysical survey along transects spaced at 50-foot intervals until the detected anomaly density returns to background level. Geophysical anomalies potentially representing MEC in the step-out transects will be selected for intrusive investigation. Additional step-out transects and intrusive investigations will be added, if necessary, until the extent of munitions use areas are confidently delineated.

LAND SURVEYING

KEMRON will use a state of Texas registered Professional Land Surveyor (PLS) to establish survey control and to delineate the extent of the AOI where needed to conduct RI field activities. Land survey activities will be conducted in accordance with all U.S. Army Environmental Command and USACE guidance. The land survey teams will be escorted at all times by UXO technicians for anomaly avoidance.

The PLS will research, recover, and confirm the existing horizontal and vertical control networks within or near the AOI, including at least three recoverable control points for RI field team use. If necessary, control points will be established to provide GPS base station locations with sufficient coverage of the AOI. The PLS will provide a description of the monuments used for the survey and the data and recovery sheets for existing and new control points, including coordinate values and recovery descriptions.

During RI activities, field teams will use handheld GPS units and existing features to identify and reference boundary lines as well as to mark/identify features of interest and areas of inaccessibility. This will minimize the required boundary surveys. Survey stakes will be installed at the AOI boundary corner points. Where needed, the site boundaries will be marked using highly visible flagging tape along the investigation area boundary.

A land survey report will be prepared by the PLS, including a narrative of all work performed with locations provided in the Universal Transverse Mercator (UTM) coordinate system using the World Geodetic System (WGS) 1984 horizontal datum. The survey report will describe the equipment and methodology used to perform the work and detail the results of the survey and the accuracies obtained. The survey report will contain the coordinate information of all locations surveyed and will be stamped, dated, and signed by the PLS with certification that the work was completed in compliance with the specification.

While in the field for RI land surveying activities, the PLS will also complete the boundary survey required for fencing placement at the El Paso Museum of Archaeology and the National Border Patrol Museum on the closed Castner Range. The fencing task will involve the installation of approximately 3,400 feet of fencing, including signage, to support the required land use control measure for the closed landfill area containing the El Paso Museum of Archaeology and the National Border Patrol Museum. The fence alignment will be established by the PLS with UXO technicians providing anomaly avoidance.

The initial boundary survey will be conducted to verify that the fence and signage locations are entirely within Fort Bliss property.

Following fence installation, the PLS will survey the fence alignment and add the fence and signage location data to the survey plat to show the final alignment.

VEGETATION REMOVAL

It is anticipated that minimal vegetation removal will be required to conduct RI field activities. Where possible, investigation transects will vary up to 10 feet laterally from the planned transect location to avoid vegetation. Where vegetation that precludes the safe and uninhibited passage of DGM data acquisition cannot be avoided, vegetation removal will be conducted. Vegetation removal teams will use handheld GPS devices to locate the planned transects and mechanical or manual brush-clearing equipment to clear the transects of vegetation to within 6 inches of the ground surface to allow the uninhibited passage of the geophysical system.

GEOPHYSICAL SYSTEM VERIFICATION

KEMRON will use the GSV process to verify the functionality of the geophysical system before beginning DGM activities and throughout the geophysical investigation work. The GSV process is a physics-based technology verification approach in which signal strength and sensor performance are initially demonstrated through an IVS and system function tests, and continuously throughout data acquisition activities through daily IVS surveys, system function tests, and a blind-seeding program. Initial verification of the DGM system will be conducted at an IVS composed of industry standard objects (ISO) buried at precisely measured locations and depths. The results will be compared to expected response values of ISO at those burial depths. An IVS memorandum will be prepared following the initial IVS survey documenting the construction of the IVS, the initial IVS survey and geophysical system details, and the results of the IVS survey. The IVS Memorandum will be submitted to USACE for review and approval prior to the onset of DGM data acquisition activities.

Continued verification of DGM system performance will be accomplished through daily IVS surveys and system function tests as well as through the implementation of a blind seeding program. The use of blind seed items in a transect-based geophysical investigation is inherently problematic due to the difficulty of placing seed items in locations that will be traversed during the DGM survey while protecting the integrity of the QC system by maintaining appropriate separation between QC seed item information and the data acquisition team. This difficulty will be mitigated by burying QC items at some point along a 30-foot section of the planned investigation transect and marking each end of that section with polyvinyl chloride (PVC) survey flags. The locations of seed items along the lines will be recorded utilizing RTK-GPS and provided directly to QC personnel. The flagged endpoints of the line will allow transect data to be acquired over the seed item without compromising the integrity of the QC program.

QC seed items buried along the geophysical survey transects will be used for ongoing verification of the detection, identification, and intrusive investigation processes. QC seed items will be buried at a frequency such that at least one seed item, on average, is encountered by each DGM data acquisition team each day of the geophysical survey. For analog investigation transects, additional seed items will be buried at a frequency such that at least one seed item, on average, is encountered by each investigation team member each day. The QC seed item locations will not be provided to data acquisition or other operational personnel until the operation being verified has been completed. The measures put in place to maintain appropriate separation between QC information and operational project personnel are described in the Blind Seed Firewall Plan (**Appendix I**).

ANOMALY AVOIDANCE

Due to the relatively low likelihood of encountering MEC in the majority of the AOI, a stand-alone surface MEC removal will not be conducted along the investigation transects before geophysical surveys. One position on the geophysical data acquisition team will be filled by a UXO Technician II or UXO Technician III. The UXO technician will guide the geophysical data acquisition using anomaly-avoidance principles while identifying and avoiding potential surface MEC or MPPEH items along the transect path. Potential surface MEC and MPPEH items will be photographed and flagged for future investigation, and their locations will be recorded with GPS.

GEOPHYSICAL INVESTIGATION

KEMRON will conduct geophysical surveys along the 3-foot wide transect paths previously described to identify subsurface geophysical anomalies potentially related to MEC or elevated concentrations of metallic debris indicative of the potential presence of MEC within the AOI. The primary geophysical survey method will be DGM using an ATV-towed single-coil EM61 with positioning provided by integrated RTK-GPS. Based on site conditions throughout the AOI, the ATV-towed system will be supplemented by person-portable EM61 DGM in areas that cannot be efficiently traversed by the ATV-towed system. In areas where terrain conditions preclude the safe use of either DGM operation, the geophysical survey will be conducted by UXO technicians using analog handheld EM detectors. USACE will be consulted prior to the identification of transects requiring analog investigation. Both DGM and analog geophysical surveys will follow the designed survey transects to the extent possible, but could vary from the transects if necessary to avoid obstacles caused by terrain or vegetation or to avoid safety concerns. The analog geophysical team will use sub-meter accuracy GPS to track the actual surveyed transect paths and to record the locations of MEC and MPPEH items.

The DGM data will be processed and analyzed by MEC-experienced data processing geophysicists using Geosoft UXO Land for Oasis montaj software. The following criteria, supplemented by site-specific target of interest information, will be applied to target selection.

- Maximum response amplitude with respect to local background conditions
- Shape of the response peak
- Electromagnetic signal decay characteristics
- Location of the anomaly with respect to terrain features, cultural features, or utilities within or near the transect.

Geophysical anomalies for intrusive investigation will initially be selected using automated target-selection tools. Each identified target anomaly will then be analyzed by the data processing geophysicist to evaluate its validity and position. Invalid or incorrectly located target anomalies will be removed or adjusted. The processed data will also be reviewed for potential target anomalies that were not identified by the UX-Detect target selection routine. These targets will be manually added to the target list.

Anomalies identified during analog transect surveys will be investigated in real time, and MEC and MPPEH item locations will be recorded using sub-meter accuracy GPS as described in the intrusive investigation discussion below.

Based on the results of the previous study conducted by USACE and the fact that no records exist of military use of the AOI, it is anticipated that subsurface anomaly densities will be low throughout the AOI. If, however, the target anomaly population identified during data processing and analysis is larger than anticipated, a statistically representative sample of anomalies potentially representing MEC will be selected for intrusive investigation using the estimating-a-proportion statistical method at a confidence level agreed upon by the project delivery team and USACE. Prior to initiating the intrusive investigation of a statistically representative subset of anomalies (rather than the entire detected anomaly population) in

any portion of the AOI, a Statistical Anomaly Selection Technical Memorandum will be prepared and submitted to USACE for approval. The Technical Memorandum will present the rationale for utilizing the statistical investigation approach in that specific area (including detected anomaly density information), a detailed explanation of the statistical selection method (including mathematical formulas and equations used), and the proposed intrusive investigation target information. Subsequent excavation of selected anomalies will be used to characterize the nature of MEC items present in the AOI and to delineate the spatial distribution and density of the MEC, and soil sampling will be used to identify potential MC contamination. Anomaly density maps will be produced using the VSP geostatistical density mapping tools to model and characterize the extent of subsurface metallic contamination.

REACQUISITION

KEMRON survey personnel, accompanied by a UXO technician for anomaly avoidance, will reacquire the DGM anomalies selected for intrusive investigation using RTK-GPS and an EM61. Anomaly locations will be marked with survey paint at the refined target location, and a PVC survey flag will be placed near the target location. The PVC survey flag will be marked with the unique anomaly identification in indelible ink.

INTRUSIVE INVESTIGATION

Intrusive investigation teams consisting of a minimum of one UXO Technician III, one UXO Technician II or higher, and one UXO Technician I, will investigate the reacquired anomalies and digitally record the results of each investigation in GPS-enabled handheld field devices. The intrusive investigation teams will use handheld EM detectors (after daily functional checks have been completed) to assist in the location of anomaly sources and verification of anomaly resolution. Specific intrusive investigation procedures are detailed in UXO SOP 3 (Intrusive Investigation Using Analog Methods) and UXO SOP 4 (Intrusive Investigation of DGM Targets).

MEC, MPPEH, AND MDAS MANAGEMENT

KEMRON will conduct all demilitarization, verification, and manifesting associated with MEC, MPPEH, and MDAS disposal. Disposal of MEC/MPPEH items will take place through either BIP or consolidated explosive demolition. Demolition operations will take place at the end of each day of discovery, or at less frequent intervals as dictated by need.

Due to the nature of the work environment, which includes privately owned properties adjacent to the AOI, the security of recovered MEC items will be required if the items will be left in place overnight. In the event that demolition and disposal activities cannot be completed before the end of the work day, the item(s) will be left in their field location(s) until the demolition operation takes place, and guards will be posted at the location(s) during non-working hours. A safety briefing will be performed at each change of guard shift.

Demolition and disposal activities are not expected within proximity of the adjacent residential community. In the event that evacuations are required, a detailed plan for evacuation notifications and procedures will be provided in the CRP, with notifications for affected residents occurring 24 hours before demolition activities. Items scheduled for demolition will be guarded as described above. Immediately before demolition activities, KEMRON personnel will verify that the area is clear except for essential personnel and will post guards in appropriate areas to prevent ingress until completion of demolition activities. Evacuated residents will be provided with a pet-friendly rallying point and will be notified when it is safe to return to their homes.

Explosives Acquisition
All explosives required for demolition activities will be acquired on demand as needed. Before each demolition activity, the SUXOS will place an order with a local licensed explosives supplier. The necessary supplies will be delivered to KEMRON's project office location, where the SUXOS will assume accountability for the material and sign the receipt documents. The SUXOS will conduct a 100% inventory of the incoming explosives to confirm that the quantities annotated on the receiving document match the quantities received. The SUXOS will only sign for the actual quantity of material received, as reflected by the inventory. These procedures will be followed for each delivery. Handling and transportation of the explosives will follow all Bureau of Alcohol, Tobacco, Firearms and U.S. Department of Transportation safety rules and other applicable regulations.

Exclusion Zone
Before demolition activities, an exclusion zone (EZ) will be established around the planned detonation point based on the munition with the greatest fragmentation distance in the demolition event. The UXOSO will notify the USACE OESS, Fort Bliss Range Control personnel, and local first responders of the planned demolition activity. Property owners within the planned detonation EZ will be notified and evacuated in accordance with the CRP. Before items are prepared for demolition, all non-essential personnel will be evacuated from the EZ and will remain outside the EZ until demolition and disposal operations are completed. The UXOSO will account for all personnel and verify that the area is secure before SUXOS authorization to initiate explosive detonation.

MEC and MPPEH Accountability
KEMRON will prepare and maintain a detailed accounting of all MEC items/components encountered during RI activities. A daily operations log will include the following information.

- Date and time operations began
- Date and time operations were completed
- Amounts, nomenclature, and condition of MEC (i.e., UXO, MPPEH, or MEC)
- Location and depth of MEC and MPPEH
- Disposition method of MEC and MPPEH.

An explosive accountability log will account for all demolitions materials used to destroy MEC and MPPEH on site. Digital photography will also be incorporated to ensure MEC accountability and identification of MEC and MPPEH recovered during investigation activities and to track explosive accountability and destruction of MEC and MPPEH.

Munitions Debris, MDAS, NMRD and RRD MDAS and Non munitions Related Debris (NMRD) will be removed from the investigation area and disposed of offsite in accordance with the inspection, certification, and disposition procedures in EM 385-1-97 (USACE, 2013). Lockable metal containers will be located in an area reserved for MDAS collection, segregation, and final inspection. Two containers (one for non-ferrous and one for ferrous material) will be designated "Non-Munitions Related Debris" and will be used to collect non-ordnance debris such as C-ration cans, barbed wire, range debris, and or other metallic debris not associated with munitions or range targets. Two additional containers (one for non-ferrous and one for ferrous material) will be marked "MDAS" and will be used to collect ordnance/munitions-related metal such as target material, fins, empty projectile casings, ordnance fragments, and other metal components that do not contain any explosives or energetic materials. Management of MPPEH will meet requirements set forth in Department of Defense Instruction 4140.62 and EM 385-1-97 (USACE, 2013)

The sorting, inspection, and segregation of MPPEH will begin with an initial screening by the UXO Team Leader when a metal item is discovered in the field to determine the classification of the item. If the item

cannot be positively identified as MDAS, it will be left in place and flagged for demolition. If the item is positively identified as non-ordnance metal, it will be placed in a non-ordnance bucket. If the item is identified as MD, the material will be placed in an MD-designated bucket.

Periodically throughout the day, the UXO team will consolidate all materials that are to be processed through the MDAS processing area. At this point, the UXO Team Leader will perform the second inspection by sorting and separating the items. If any questionable item is found in the non-ordnance bucket, it will be moved to the MD bucket. The non-ordnance range-related debris will be placed with like materials, while the ordnance-related MD will be staged for disfigurement/ demilitarization. Demilitarization will meet requirements set forth in Department of Defense Manual 4160.28, Volumes 1-3.

The final inspection will be conducted by both the SUXOS and the UXOSO/UXOQCS. This will prevent ordnance-related items from being removed from the RI area without three separate inspections to verify that they are free of all explosives or energetic material.

All MDAS will be certified as being free of energetic material and placed into the lockable MDAS-labeled container(s). Before removing MDAS from the site, the MDAS manifest will be signed and seal numbers recorded. All MDAS will be disposed of at a foundry or recycler where it will be processed through a shredder, smelter, or re-melt furnace before resale or release. The non-ordnance range-related debris will be transported to the same facility. All MDAS containers will remain segregated from other containers and sealed until processed for shredding and/or smelting. All MDAS will be rendered unrecognizable as munitions-related debris, disposed of safely and permanently, and tracked from point of origin to final disposition. A signed DD Form 1348-1 and a certificate of destruction signed by the disposal facility will be required to track all MDAS. These documents will become part of the permanent record for submittal with the final report. All MDAS inspections will meet local, state, and federal requirements.

QAPP WORKSHEET #17B: SAMPLING DESIGN AND RATIONALE (MC)

The RI at the AOI North of Castner Range is being conducted to characterize the nature and extent of potential MEC and MC contamination within the AOI. The RI will be followed with an FS to present alternatives by which to address the findings of the RI, and a PP and DD to guide potential future remediation efforts. The RI is composed of investigations for MEC and for MC, the latter of which will be based in part on the results of the former.

The investigation for MC will include the following field activities.

- MC sampling.

MUNITIONS CONSTITUENTS SAMPLING

Only soil samples will be collected, because evaluating surface water, sediment, and groundwater indicates that site conditions would preclude MC impacts to these media. The soil sampling will consist of a combination of IS and biased composite sampling to collect a representative soil sample.

Incremental Sampling Methodology

IS sampling unit areas will be based on the MEC RI geophysical survey results, with input from the stakeholders. If no/not enough IS sampling locations are identified, IS will be collected in sampling locations such as in proximity to the residential neighborhood adjacent to the AOI or designated camping and picnic areas as well as "worst-case scenarios;" that is, locations most likely to exhibit elevated concentrations of MC. Locations of MEC finds, visual observations, and ecological habitat and potential receptors will also be considered when selecting DU locations. Specifically, criteria will include one or more of the following.

- Areas with high density or frequency MEC/MD as determined by the geophysical investigation
- Berms, craters, targets, firing points, or other physical features typically associated with MEC/MD impacts or accumulations
- Topographic features such as natural depressions, drainages, and/or similar terrain features that represent points where MC is likely to accumulate
- In close proximity to the residential neighborhood adjacent to the AOI or near a campsite or picnic area.

Incremental sampling methodology (ISM) yields a reliable mean concentration of energetic residue in a sampling unit. The ISM sampling unit area is based on the results of the site reconnaissance and DGM with input from the stakeholders. The sampling approach in each DU defined will be a systematic random sampling approach with samples taken at a specific increment across the sampling unit. Energetic residue includes both explosive and metal residue. The procedures described below account for both analytical groups.

1) **Reconnaissance**. The initial reconnaissance work at the site will include a combination of conducting visual surveys along transects and reviewing MEC data and DGM data locations in the field, and identifying locations with "worst-case scenarios."

2) **Sampling**. **S**oil samples will be collected using ISM and analyzed at an off-site laboratory for the presence of select explosives and metals. The COC list is found in Worksheet #15. This sampling technique collects multiple soil sample increments that are distributed relatively evenly throughout each DU. This technique enhances sample representativeness and minimizes sampling errors.

Detailed ISM procedures are described in SOP PR-TC-02.02.01.06, which is included in **Appendix H**.

The accessible portion of each investigation zone will be subdivided into sampling units for soil sampling. Unless restricted by topography or surface features, each DU will be 1 acre. The size and location of each sampling unit will be further refined based on input from project stakeholders. To minimize sampling error, each DU will be an area that has similar (not identical) soil characteristics and suspected contaminants throughout.

Sample increments will be collected from the 0-inch to 2-inch depth interval and in an unbiased pattern within the sampling unit. The sampling pattern selected for this project is the systematic-random approach as presented on **Figure 2-7** because it provides the most reproducible sampling pattern. The systematic-random approach (Interstate Technology Regulatory Council [IRTC], 2012) consists of subdividing the DU into uniform grid cells. The first increment is collected randomly from the initial grid cell at the start of the traverse. All subsequent increments are collected from the same relative location within each of the other grid cells along a path traversed through the entire unit.

Each sampling team will consist of two members. One team member will collect the sample increments and one will be a qualified UXO technician who will employ MEC-avoidance procedures during the sampling activities. If MEC is identified, the item will be flagged, recorded, and avoided. Work in the immediate area will stop until the UXO technician determines it is safe to resume work. Items positively identified as pieces of explosives will be handled in the same manner as other MEC items. These pieces will not be included in the soil submitted for laboratory analysis.

Approximately 30 grams of soil will be collected using a disposable scoop from each of approximately 50 sample increments collected from within each sampling unit. The sampling team will collect subsequent increments at the approximate random location selected in the starting unit along the path throughout the remaining sampling unit grids. The combined weight of the increment samples will range from 1.0 kilogram (kg) to 1.5 kg. Samples will be placed in laboratory-supplied bags to maintain sample integrity during shipment. The path will be recorded using a handheld GPS unit. It will not be necessary to record the location of each sample increment. Each sample increment will be of uniform size and mass so that each increment will have an equal possibility of incorporation into the sample analyzed by the off-site laboratory. Any visible metallic debris or fragments will be removed from the increment by hand, and notations will be made on the sample collection sheet. If the sampling unit is chosen as the QC unit, two additional replicates will be collected. Each replicate sample will be randomly chosen from a different location in the initial grid and the sampling path will proceed in a different direction with in the grid system.

If a “hot spot” (worst case) is identified within a sampling unit and would be better characterized with ISM and not discrete sampling, with stakeholder input, a field change request to subdivide the DU will be made. Vertical and horizontal step-outs will be used to determine the extent of the contamination. Co-located subsurface samples at 1-foot depth and 2-foot depth will be collected for each surface soil increment. These subsurface samples will be held at the laboratory pending the analytical results for the surface sample. The laboratory will be instructed to run the analysis on the subsurface samples after reviewing the surface data. If elevated concentrations of contaminants are detected in the IS, the IS method will be used to collect soil samples from 1-acre DUs adjacent to the contaminated DU to the north, south, east, and west. This step-out process will continue until the results are below screening levels.

Spoke-and-Hub Sampling Methodology

The spoke-and-hub sampling approach will be used to obtain a reliable mean concentration of MC from locations where the presence of cracked or leaking MEC items is identified or where detonation activities occur in support of the RI. Spoke-and-hub soil samples will be collected from each BIP location; however, sampling at a consolidated shot location will only be conducted after the last detonation.

The Cold Regions Research Engineering Laboratory (CRREL) scheme (CRREL, 1999) for composite soil sampling will be used at all BIP and post-consolidation shot locations. Seven samples will be collected in a wheel pattern with sample number 1 as the center hub. A template will be placed on the ground with the center at the selected sampling location and oriented as shown on **Figure 2-8**, with sample numbers 2 and 5 oriented north-south. The radius of the wheel will be 2 feet and samples arranged around the wheel approximately 2 feet apart.

All seven soil samples will be collected from the 0-inch to 2-inch depth interval using a manual 5.0-cm stainless-steel hand auger. If vegetation and visible metallic debris or fragments are present, they it will be removed by hand and notations will be made on the sample collection sheet. Samples will be placed in laboratory-supplied bags to maintain sample integrity during shipment. The sample location will be recorded using a handheld GPS unit. It will not be necessary to record the location of each sample increment.

Co-located subsurface samples at 1-foot depth and 2-foot depth will be collected for each surface soil increment. These subsurface samples will be held at the laboratory pending the analytical results for the surface sample. The laboratory will be instructed to run the analysis on the subsurface samples after reviewing the surface data. If elevated concentrations of contaminants are detected in sample, identical procedures will be used to collect soil samples from horizontal step-outs to determine the extent of the contamination. Step-out soil samples will be collected from 10 feet to the north, south, east, and west of the initial elevated sample location. This step-out process will continue until the results are below screening levels. Spoke-and-hub samples will be analyzed at an off-site laboratory for the presence of select explosives. The COC list is found in Worksheet #15.

QAPP WORKSHEET #18: SAMPLING LOCATIONS AND METHODS

Worksheet #18 is applicable only to DQO #2 (MC Sampling).

The primary value of this worksheet is as a completeness check for field personnel and auditors/assessors. It facilitates checks to ensure all planned samples have been collected and appropriate methods have been requested on chain of custody forms. Detailed sampling SOPs will be available to field personnel and are included in **Appendix H**.

The sampling scheme is presented in the table below.

Location ID[1]	Sample ID[1]	Matrix	Depth (feet)	Analytical Group	Sampling SOP Reference	Sampling Rationale	Number of Samples
AOINCRDUYY	AOINCRDUYY-ZZ-AABB-depth	Soil	TBD	Explosives Metals	PR-TC-02020106	TBD	35
AOINCRSHYY	AOINCRSHYY-ZZ-AABB-depth	Soil	TBD	Explosives	PR-TC-02031200	TBD	6
AOINCRFBYY	AOINCRFBYY-ZZ-AABB	Water	NA	Explosives Metals			One per day

Notes:

TBD = to be determined
Where: AOINCR designates the site name Area of Interest North of Castner Range
The type of sample is designated as DU for decision unit, SH for spoke-and-hub composite, FB for field blank. SH samples will be either BIP or consolidated shot locations.
YY designates the specific sample location (01, 02, 03, etc.). This 2-digit number begins at 01 every year.
ZZ designates a normal or QA/QC sample. The number may be any of the following:
- 00 = normal field sample
- 01 = QC duplicate or replicate
- 02 = QA split
- 03 = field (source) blank

AA designates the month a sample is collected (e.g., 01 for January, 02 for February, etc.)
BB designates the year a sample is collected (e.g., 17 for 2017, 18 for 2018, etc.)

QAPP WORKSHEET #19 & 30: SAMPLE CONTAINERS, PRESERVATION AND HOLD TIMES

Sample Containers, Preservation, and Hold Times

Primary Laboratory: TestAmerica
4955 Yarrow Street
Arvada, Colorado 80002
Phone: 303-736-0107

Sample Delivery Method: Overnight courier

Analyte/ Analyte Group	**Matrix**	**Method** (See Worksheet #23 for SOPs)	**Accreditation Expiration Date**	**Container(s)** (number, size and type per sample)	**Preservation**	**Preparation Holding Time**	**Analytical Holding Time**	**Data Package Turnaround**
Explosives	Soil	8330B/8330B	DoD ELAP: 10/31/19 NELAP: 01/08/18 Texas: 09/30/18	1.5 to 2 kg soil sample collected in laboratory provided plastic bag Laboratory provided plastic bag for spoke-and-hub samples	4 ± 2°C	14 days	40 days	14 days
Metals	Soil	3050B/6010C 3050B/6020A		1.5 to 2 kg soil sample collected in laboratory provided plastic bag	4 ± 2°C	180 days total		14 days
Explosives	Water	3535A/8330A		1-liter amber bottle	4 ± 2°C	14 days	40 days	14 days
Metals	Water	3010A/6010C 3020A/6020A		250-milliliter poly bottle	4 ± 2°C, HNO_3 to pH <2	180 days total		14 days

Secondary Laboratory: SGS Accutest
4405 Vineland Road, Suite C-15
Orlando, Florida 32811
Phone: 407-425-6700

Sample Delivery Method: Overnight courier

Analyte/ Analyte Group	**Matrix**	**Method** (See Worksheet #23 for SOPs)	**Accreditation Expiration Date**	**Container(s)** (number, size and type per sample)	**Preservation**	**Preparation Holding Time**	**Analytical Holding Time**	**Data Package Turnaround**
Explosives	Soil	8330B/8330B	DoD ELAP: 12/15/18 NELAP: 06/30/18 Texas: 05/31/18	1.5 to 2 kg soil sample collected in laboratory provided plastic bag	4 ± 2°C	14 days	40 days	14 days
				Laboratory provided plastic bag for spoke-and-hub samples				
Metals	Soil	3050B/6010C 3050B/6020A		1.5 to 2 kg soil sample collected in laboratory provided plastic bag	4 ± 2°C	180 days total		14 days
Explosives	Water	3535A/8330A		1-liter amber bottle	4 ± 2°C	14 days	40 days	14 days
Metals	Water	3010A/6010C 3010A/6020A		250-milliliter poly bottle	4 ± 2°C, HNO_3 to pH <2	180 days total		14 days

Notes:
Updated NELAP and ELAP certifications will be provided by the laboratory upon expiration.
HNO_3 = nitric acid

QAPP WORKSHEET #20A: FIELD QUALITY CONTROL SUMMARY (MEC)

Matrix	Procedure	Sample Population Applicable to QC Inspection	Minimum Number of Blind Seed Items (BSI)	Size of QC Sample
DGM Data Acquisition	All DGM-related field operations	QC Inspections (PP, IP, FP)	N/A	Variable (duration dependent)
DGM Data Acquisition	DGM Data Acquisition	15,000 linear feet of transect	1 per team per lot (1 lot is the area investigated by the team in 1 day)	15,000 linear feet of transect
DGM Data Acquisition and Data Processing	DGM Data Acquisition DGM Data Processing and Analysis	Minimum of 10% of DGM data (including targeting) to be inspected by QC Geophysicist	N/A	10% of DGM data
Sub-Surface Removal	All Analog and DGM target-related	QC Inspections (PP, IP, FP)	N/A	Variable (duration dependent)
Sub-Surface Removal	Intrusive Investigation Using Analog Methods	8,700 linear feet of transect	1 per team member per lot (1 lot is the area investigated by the team in 1 day)	8,700 linear feet of transect
Sub-Surface Removal	Intrusive Investigation Using Analog Methods	QC inspection of intrusive investigation locations in accordance with EM 200-1-15, Table 6-6	N/A	Analog investigation lot (approximately 8,700 linear feet of transect)
Sub-Surface Removal	Intrusive Investigation of DGM Targets	15,000 linear feet of transect	The number of intrusive investigations for DGM transects is unknown. BSI frequency is therefore based on data acquisition production (1 per team per lot [1 lot is the area investigated by the team in 1 day]).	15,000 linear feet of transect
Sub-Surface Removal	Intrusive Investigation of DGM Targets	QC inspection of intrusive investigation locations in accordance with EM 200-1-15, Table 6-6	N/A	DGM investigation lot (approximately 15,000 linear feet of transect)

QAPP WORKSHEET #20B: FIELD QUALITY CONTROL SUMMARY (MC)

Matrix	Analytical Group	Preparation/Analysis Reference	Approximate No. of Primary Sampling Locations	No. of Field Duplicate	No. of Field Replicates	No. of MS/MSDs	No. of Equipment Blanks	Approximate Total No. of Samples
Soil	Explosives	8330B/8330B	35	NA	4	2	1 per day	39
Soil	Metals	3050B/6010C	TBD	10%	NA	5%	TBD	TBD
Water	Explosives	3535A/8330A	TBD	NA	NA	5%	One per day	TBD
Water	Metals	3010A/6010C 3020A/6020A	TBD	NA	NA	5%	One per day	TBD

QAPP WORKSHEET #21A: FIELD SOPS (MEC)

This worksheet documents specific field procedures and methods that will be implemented for work conducted at the AOI North of Castner Range. Applicable field SOPs will be readily available to all field personnel responsible for their implementation. The SOPs listed below are included in **Appendix H** of this QAPP.

SOP Reference Number	Title, Revision Date and/or Number	Revision Date and/or Number	Originating Organization	Equipment Type	Is SOP specific to this project? (Yes/No)
DATA SOP 1	Field Data Management	June 2017	KEMRON	Digital Tablet	Yes
DATA SOP 2	GIS Data Management	June 2017	KEMRON	N/A	Yes
FIELD SOP 1	Munitions and Explosives of Concern Field Documentation	June 2017	KEMRON	Digital Tablet, GPS	Yes
FIELD SOP 2	Land Surveying	June 2017	KEMRON	RTK-GPS and/or Total Station Survey Equipment	Yes
FIELD SOP 3	Vegetation Removal	June 2017	KEMRON	GPS, Hand Tools, Mechanical Equipment (if used)	Yes
GEO SOP 1	IVS Installation and Use	June 2017	KEMRON	Digital Tablet, RTK-GPS	Yes
GEO SOP 2	Blind Seed Item Installation	June 2017	KEMRON	Digital Tablet, RTK-GPS	Yes
GEO SOP 3	Digital Geophysical Mapping Data Acquisition	June 2017	KEMRON	Digital Tablet, RTK-GPS, EM61	Yes
GEO SOP 4	Digital Geophysical Mapping Data Processing and Analysis	June 2017	KEMRON	Geosoft Software	Yes
GEO SOP 5	Digital Geophysical Mapping Target Reacquisition	June 2017	KEMRON	Digital Tablet, RTK-GPS, EM61	Yes
GEO SOP 6	Geophysical Quality Control	June 2017	KEMRON	Geosoft Software	Yes
UXO SOP 1	Function Check Area Installation and Use	June 2017	KEMRON	Digital Tablet, GPS	Yes

SOP Reference Number	Title, Revision Date and/or Number	Revision Date and/or Number	Originating Organization	Equipment Type	Is SOP specific to this project? (Yes/No)
UXO SOP 2	Anomaly Avoidance	June 2017	KEMRON	Digital Tablet, GPS, handheld metal detector	Yes
UXO SOP 3	Intrusive Investigation Using Analog Methods	June 2017	KEMRON	Digital Tablet, GPS, handheld metal detector, EM61	Yes
UXO SOP 4	Intrusive Investigation of DGM Targets	June 2017	KEMRON	Digital Tablet, GPS, handheld metal detector, EM61	Yes
UXO SOP 5	MEC and MPPEH Management	June 2017	KEMRON	Digital Tablet, GPS (if used)	Yes
UXO SOP 6	Demolition of MEC, MPPEH and MDEH	June 2017	KEMRON	Digital Tablet, GPS	Yes
UXO SOP 7	Explosives Management	June 2017	KEMRON	Digital Tablet	Yes
UXO SOP 8	Explosives Siting/Exclusion Zones	June 2017	KEMRON	N/A	Yes
UXO SOP 9	QC of MEC and Explosives Related Operations	June 2017	KEMRON	Digital Tablet, GPS, hand-held metal detector, EM61 (if used)	Yes

QAPP WORKSHEET #21B: FIELD SOPS (MC)

This worksheet documents specific field procedures and methods that will be implemented for work conducted at the AOI North of Castner Range. Applicable field SOPs will be readily available to all field personnel responsible for their implementation. The SOPs listed below are included in **Appendix H** of this QAPP.

SOP Reference Number	Title, Revision Date and/or Number	Revision Date and/or Number	Originating Organization	Equipment Type	Is SOP specific to this project? (Yes/No)
PR-TC-01040100	Field Documentation	June 2013/v2	Gilbane	NA	No
PR-TC-01040400	Creating a Sample Identification System	July 2015/v2	Gilbane	NA	No
PR-TC-01040500	Chain-of-Custody Procedures for Environmental Samples	August 2014/v2.1	Gilbane	NA	No
PR-TC-02020101	Surface Soil: Sampling with Trowel or Spoon	August 2016/v2.1	Gilbane	Trowel or Spoon	No
PR-TC-02020102	Shallow Soil: Drive Sampler, Hand Auger or Test Pit	July 2015/v2	Gilbane	Drive sampler or hand auger	No
PR-TC-02020106	Soil: Incremental Sampling Methodology (ISM) for Munitions Constituents at Military Training Ranges	March 2017/v2a	Gilbane	ISM sampler or spoon	No
PR-TC-02031200	Field Equipment: Decontamination of Field Sampling Equipment	March 2015/v1	Gilbane	NA	No
PR-TC-02040101	Sample Handling, Packaging and Shipping	August 2014/v2.1	Gilbane	NA	No
PR-TC-0212200	Sample Tracking and Electronic Data Management	Jan 2014/v2.1	Gilbane	NA	No
PR-TC-04010000	Review, Verification, and Validation of Chemical Data	March 2014/v2	Gilbane	NA	No

QAPP WORKSHEET #22: FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

This worksheet documents procedures for performing testing, inspections, and quality control for all field data collection activities. MC field data collection activities are limited to soil sampling and have no additional equipment calibration, maintenance, testing, or inspection requirements.

Field Equipment	Calibration Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Document/ SOP Reference[1]
Hand-held metal detectors	Standardization	Daily	Per manufacturer's specifications	Fix or replace	Field Team Leader	UXO SOP 1 UXO SOP 2 UXO SOP 3 UXO SOP 4
	Repeatability	Daily	Per manufacturer's specifications	Replace instrument or retrain operator		
Digital Geophysical Instruments (EM61)	Standardization	Daily	Per manufacturer's specifications	Fix or replace	DGM and UXO team members	GEO SOP 1 GEO SOP 3 GEO SOP 4 GEO SOP 5 GEO SOP 6 UXO SOP 3 UXO SOP 4

Field Equipment	Calibration Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Document/ SOP Reference[1]
Digital Geophysical Instruments (EM61)	Repeatability	Daily	**Static Repeatability – Background:** 98% of daily static background response values (no test object) will not exceed +/- 2 mV of the expected baseline response (for all EM61 channels) **Static Repeatability – Spike:** 98% of response values to the standard spike test item (a small ISO fixed at an orientation and distance from the sensor to provide an approximately 100-mV response on channel 2 of the EM61) will not exceed +/- 20% of the expected baseline response (for all EM61 channels) **Dynamic Repeatability (IVS) – Background**: 98% of the dynamic background response values during the daily IVS survey will not exceed +/- 3 mV of the expected baseline response (for all EM61 channels) **Dynamic Repeatability (IVS) – Spike**: Instrument response to each IVS item will not exceed +/- 25% or +/- 2 mV (whichever is greater) of the expected baseline response (for all EM61 channels) **Cable Shake Test.** 98% of response value fluctuation due to movement of system cables will not exceed +/- 2 mV (for all EM61 channels) **Personnel Test (PP EM61 only).** 98% of response value fluctuation due to proximity of data collection personnel will not exceed +/- 2 mV (for all EM61 channels) **Tow Vehicle Test (Towed EM61 only).** 98% of response value fluctuation due to elevated tow vehicle RPM will not exceed +/- 2 mV (for all EM61 channels)	Replace instrument or retrain operator	DGM and UXO team members	GEO SOP 1 GEO SOP 3 GEO SOP 4 GEO SOP 5 GEO SOP 6 UXO SOP 3 UXO SOP 4

Field Equipment	Calibration Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Document/ SOP Reference[1]
RTK-GPS	Repeatability	Daily (for DGM-related operations)	**GPS Static Position Check:** GPS position checks will not exceed ± 3 inches (7.6 cm) from the established baseline position	Replace instrument or retrain operator	RTK-GPS Operators (including DGM team members)	GEO SOP 2 GEO SOP 3 GEO SOP 5
Sub-meter GPS	Repeatability	Daily (for analog-related operations)	**GPS Static Position Check:** GPS position checks will not exceed ± 39 inches (100 cm) from the established baseline position	Replace instrument or retrain operator	GPS Operators	UXO SOP 1 UXO SOP 2 UXO SOP 3 UXO SOP 4 UXO SOP 5

Notes:
[1]SOPs are listed in Worksheet #21A

QAPP WORKSHEET #23: ANALYTICAL SOPS

Preparation/Analytical Method References Table

The SOPs referenced below are the laboratory-specific procedures for the tests for which the laboratories are certified under DoD ELAP and NELAP programs. A copy of certifications for the primary and secondary laboratories is included in **Appendix H**. Updated DoD ELAP and state certifications will be provided by the laboratory upon expiration. The SOPs are for the laboratories presented Worksheet #19 and 30.

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Equipment Type or SOP Option	Analytical Group/Matrix Soil (S), Water (W) or Air (A)	Modified for Project? Y/N
Primary Laboratory – TestAmerica Denver					
DV-IP-0010	Acid Digestion of Aqueous Samples for Metals Analysis by ICP, 06/30/17 Rev. 10 Methods: 3005A, 3010A	Definitive	Digestion block	Metals Matrix: W	N
DV-IP-0014	Acid Digestion of Aqueous Samples for Analysis by ICP-MS, 10/31/17, Rev. 10 Methods: 3005A, 3020A, 200.8	Definitive	Digestion block	Metals Matrix: W	N
DV-IP-0015	Acid Digestion of Solids, 10/31/2017, Rev109. Method: 3050B	Definitive	Digestion block	Metals Matrix: S	N
DV-LC-0002	Nitroaromatic and Nitroamine Explosive Compounds by High Performance Liquid Chromatography (HPLC), 06/30/17, Rev 19. Methods: 8330A, 8330B	Definitive	HPLC	Explosives Matrix: S & W	N
DV-MT-0021	ICP Analysis for Trace Elements by SW-846 Method 6010C/D, 07/31/17, Rev. 6	Definitive	ICP	Metals Matrix: S & W	N
DV-MT-0022	Inductively Coupled Plasma Mass Spectrometry for Trace Element Analysis, 10/31/17, Rev. 7 Method: 6020A/B	Definitive	ICP-MS	Metals Matrix: S & W	N
DV-OP-0013	Incremental Sampling Methodology for Soils and Sediments, 10/15/17, Rev 10. Method: 6323	Definitive	Sonicator	Matrix: S	N
DV-OP-0017	Solid Phase Extraction of Nitroaromatic and Nitroamine Explosive Compounds and Picric Acid from Water Samples, 10/31/17, Rev. 8 Method: 3535A	Definitive	Extractor Disc	Metals Matrix: W	N

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Equipment Type or SOP Option	Analytical Group/Matrix Soil (S), Water (W) or Air (A)	Modified for Project? Y/N
DV-OP-0018	Extraction of Nitroaromatic Explosive Compounds and Picric Acid from Soil Samples, 10/05/17, Rev 9. Methods: 8330A, 8330B	Definitive	Sonicator	Matrix: S	N
Secondary Laboratory – SGS Accutest					
GC 034.8	Analysis of Nitroaromatics, Nitramines, and Nitrate Esters by HPLC, August 2017 Method: 8330B	Definitive	HPLC	Explosives Matrix: S	N
MET 100.15	Metal by Inductively Coupled Plasma Atomic Emission Spectrometry, June 2016 Methods: 6010C, EPA 200.7	Definitive	ICP	Metals Matrix: S & W	N
MET 103.14	Digestion of Water Samples for ICP Analysis, June 2016 Methods: 3010A, EPA 200.7, EPA 200.8	Definitive	Digestion block	Metals Matrix: W	N
MET 104.12	Digestion of Soils for ICP Analysis, June 2016 Method: 3050B	Definitive	Digestion block	Metals Matrix: S	N
OP 018.10	SOP for the Extraction of Explosives (Nitroaromatics, Nitramines and Nitrate Esters) from Water Samples for HPLC Analysis, August 2015 Methods: 3535A/8330A, 3535A/8330B, 3535A/8332	Definitive	Extractor Disc	Explosives Matrix: W	N
OP 046.5	SOP for the Extraction of Nitroaromatics and Nitramines (Explosives) from Solid Samples for HPLC Analysis, September 2015 Method: 8330B	Definitive	Sonicator	Explosives Matrix: S	N

QAPP WORKSHEET #24: ANALYTICAL INSTRUMENT CALIBRATION

Worksheet 24-1. HPLC Calibration

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
HPLC	Initial calibration (ICAL)	Minimum 5 levels for linear and 6 levels for quadratic. Lowest level ≥ laboratory LOQ Levels should be within the working range of the detector.	At instrument set-up, prior to sample analysis and after ICV or CCV failure.	The signal-to-noise ratio at the LOQ must be at least 5:1. If least squares regression is used: $r \geq 0.995$; If internal standardization is used: RSD ≤15%	Correct problem then repeat ICAL.	Laboratory Manager/Analyst	DV-LC-0002
HPLC	Initial calibration verification (ICV) (second source)	NA	Once per ICAL and at the beginning of the analytical shift.	Second-source value ≤ 20% of true value	Correct problem then repeat ICV. If ICV fails repeat initial calibration	Laboratory Manager/Analyst	DV-LC-0002
HPLC	Retention time check	NA	Immediately following ICAL, prior to sample analysis.	Position shall be set using the midpoint standard of ICAL curve; CCV standard when ICAL is not preformed.	NA	Laboratory Manager/Analyst	DV-LC-0002

Notes:
Reference: QSM (DoD, 2017), Appendix B, Table B-2.

Worksheet 24-2. Inductively Coupled Plasma (ICP)/Atomic Emission Spectroscopy (AES) Calibration

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
ICP/AES ICP/mass spectroscopy (MS)	Linear dynamic range or high-level check standard		Every 6 months with a high standard at upper limit of the range.	Within ± 10% of true value.	NA	Laboratory Manager/Analyst	DV-MT-0021 DV-MT-0022
ICP/AES ICP/MS	ICAL	Calibration curve covers the appropriate concentration range based on the intended application. The highest standard should not exceed the linear dynamic range of the instrument. Minimum one high standard and a calibration blank.	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, $r^2 \geq 0.99$.	Correct problem, then repeat ICAL	Laboratory Manager/Analyst	DV-MT-0021 DV-MT-0022
ICP/AES ICP/MS	ICV (second source)	NA	Once after each ICAL, prior to beginning a sample run.	Value of second source for all analyte(s) within ± 10% of true value.	Correct problem and verify second source standard. Re-run ICV. If that fails, correct problem and repeat ICAL.	Laboratory Manager/Analyst	DV-MT-0021 DV-MT-0022
ICP/AES ICP/MS	CCV	NA	After every 10 field samples and at the end of the analysis sequence	Value within ± 10% of true value.	Correct problem, re-run calibration verification. If that fails, then repeat ICAL. Re-analyze all samples since the last successful calibration verification or immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis.	Laboratory Manager/Analyst	DV-MT-0021 DV-MT-0022

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
					If either fails, take corrective action(s) and re-calibrate; then reanalyze all affected samples since the last acceptable CCV.		
ICP/AES ICP/MS	Low-level calibration check standard (ICP only)	NA	Daily, after one-point ICAL.	Within ± 20% of true value.	Correct problem, then re-analyze.	Laboratory Manager/Analyst	DV-MT-0021 DV-MT-0022
ICP/AES ICP/MS	Initial calibration blank (ICB)/continuing calibration blank (CCB)	NA	ICB after ICAL before sample run, CCB after every 10 samples, and at end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and re-analyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.	Laboratory Manager/Analyst	DV-MT-0021 DV-MT-0022
ICP/AES ICP/MS	Interference check solutions (ICS) (also called spectral interference checks)	NA	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked project analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value.	Terminate analysis; locate and correct problem; re-analyze ICS, reanalyze all samples.	Laboratory Manager/Analyst	DV-MT-0021 DV-MT-0022

Notes:
Reference: QSM (DoD, 2017), Appendix B, Tables B-8 and B-9.

QAPP WORKSHEET #25: ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION

Preventive maintenance programs will be established for crucial sampling and/or analytical equipment to assure the timely and effective completion of a measurement effort by minimizing the down time from unexpected component failure. Program features will be focused in three principal areas:

1. Maintenance responsibilities,
2. Maintenance schedules for major and/or critical instrumentation and apparatus, and
3. Inventory of critical spare parts and equipment.

Each laboratory performing analyses will be required to have a preventive maintenance program in place and outlined in its respective QA plan. KEMRON will review the laboratory's QA plan to verify that the preventive maintenance program meets the specifications of this QAPP.

Equipment and apparatus used in environmental measurement programs fall into two general categories:

1. Equipment permanently assigned to a specific laboratory (e.g., metals laboratory, wet chemistry laboratory), and
2. Field sampling equipment available for use during the field effort.

Maintenance responsibilities for laboratory instruments will be assigned to the respective laboratory manager or other designated supervisory staff. The laboratory manager will establish maintenance procedures and schedules for each major instrument. Although this responsibility may be delegated to laboratory personnel, the manager retains responsibility for assuring adherence to the prescribed protocols. All laboratories will be bound by analytical contractual agreements to maintain the ability to produce data that meet the project objectives and to follow method specifications. This ensures that adequate spare parts, maintenance, schedules, and emergency repair services will be available.

All supplies involved in sample collection, including but not limited to sample bottles, gloves, preservatives, and sample management supplies, will be inspected upon receipt and replaced as needed prior to the field activities. The laboratory will also inspect supplies and consumables before their use in analysis.

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Method Reference[1]
HPLC/ultraviolet (UV)	Manufacturer's Specifications	Explosives QC Check	Continuing Calibration verification	Prior to sample analysis and every 10 field samples analyzed, and at the end of the analysis sequence.	All analytes and surrogates within ±20% of the value expected in ICAL.	Correct problem then repeat CCV. If analysis still fails repeat ICAL.	Laboratory Manager	8330A 8330B
HPLC/UV	Method 8330B Specifications	Explosives QC Check	Soil Triplicate	One per sample batch. Cannot be performed on any type of blank sample.	The RSD for results above the LOQ must not exceed 20%	The grinding process should be investigated to ensure that the samples are being reduced to a sufficiently small particle size.	Laboratory Manager	8330A 8330B
ICP-AES	Perform leak test, change pump tubing, change torch and window, clean filters	Metals QC Check	Monitor instrument performance via CCV and CCB	As needed	No maintenance is required as long as instrument QC meets DoD criteria	Change pump tubing, change torch and window, clean filters; recalibrate and reanalyze affected data	Analyst, Supervisor	6010C
ICP-MS	Clean nebulizer, torch, and cones as necessary. Inspect pump tubing. Inspect water levels in chiller.	Metals QC Check	Monitor instrument performance via tune, CCV and CCB	As needed	No maintenance is required as long as instrument QC meets DoD criteria	Change pump tubing, clean torch, nebulizer and cones by acid soak or sonication. Call for service.	Analyst, Supervisor	6020A

QAPP WORKSHEET # 26 & 27: SAMPLE HANDLING, CUSTODY, AND DISPOSAL

Sampling Organization: KEMRON
Primary Laboratory: TestAmerica Arvada, Colorado
Method of sample delivery (shipper/carrier): Overnight Courier
Number of days from reporting until sample disposal: 60

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference
Sample labeling	KEMRON	PR-TC-01040400
COC form completion		PR-TC-01040500
Packaging		PR-TC-01040101
Shipping coordination		PR-TC-01040101
Sample receipt, inspection, and log in		A designated laboratory sample custodian will accept custody of the samples and verify that the information on the sample labels matches that on the COC form(s). Pertinent information as to sample condition, shipment, pickup, and courier will also be checked on the COC or a sample condition receipt form. The temperature inside the cooler and the temperature blank will be measured immediately after the cooler is opened upon receipt at the laboratory, and the results recorded. If the temperature is out of criteria, the custodian or laboratory designee will contact KEMRON. The date and time of the receipt, method of shipment, and sample condition will also be recorded on the COC or sample condition receipt form. The custodian will then enter the appropriate data into the laboratory sample tracking system. The sample custodian will use the sample number on the sample label as well as assign a unique laboratory number to each sample. The custodian will then transfer the sample(s) to the proper analyst(s) or store the sample(s) in the appropriate secure area. The laboratory will maintain a laboratory sample custody log to track the samples through the laboratory. Data sheets and laboratory records will be retained by the laboratory as part of the permanent documentation for a period of at least 5 years.
Sample Disposal	Test America	60 days from data report release; up to 6 months on sample-specific request from KEMRON. Excess or unused samples should be disposed of by the laboratory accordance with federal, state, and local regulations.

Sampling Organization: KEMRON
Secondary Laboratory: SGS Accutest
Method of sample delivery (shipper/carrier): Overnight Courier
Number of days from reporting until sample disposal: 60

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference
Sample labeling	KEMRON	PR-TC-01040400
COC form completion		PR-TC-01040500
Packaging		PR-TC-01040101
Shipping coordination		PR-TC-01040101
Sample receipt, inspection, and log in		A designated laboratory receiving person will accept custody of the samples. The sample receiving person has the primary responsibility for (1) receiving and opening all packages, (2) immediately examining samples for damage or condition, (3) reviewing to ensure agreement between the test samples received and the COC form, and (4) accurately logging samples into laboratory information management system (LIMS). A LIMS-generated sample log or equivalent, listing all client samples in each sample shipment, will include: client/project name, client sample identifications, date/time of laboratory receipt, unique laboratory project number identifying the group of samples received, unique sample IDs, and condition of samples at time of receipt. A sample reception checklist is used to document sample receiving person's review of the COC form and the samples received. Laboratory records will be retained by the laboratory as part of the permanent documentation for a period of at least 5 years.
Sample Disposal	SGS Accutest	60 days from data report release; up to 6 months on sample-specific request from KEMRON. Excess or unused samples should be disposed of by the laboratory accordance with federal, state, and local regulations.

QAPP WORKSHEET #28: ANALYTICAL QC AND CORRECTIVE ACTION

The following table provides general guidance for the evaluation of QC analyses and the implementation of corrective action for out-of-control situations. The method-specific acceptance criteria are presented in the applicable table in Worksheet #12B and Worksheet #15.

Worksheet 28-1. Method QC Table – HPLC Methods

QC Sample	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	MPC
MB	Every analytical batch (maximum of 20 samples)	Target analytes not detected >½ LOQ and >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater)	1) Rerun 2) Evaluate batch 3) Reanalyze or qualify results as necessary	Section Manager/ Laboratory Analyst	Accuracy/Bias and Representativeness
LCS (and LCSD, if performed)	Every analytical batch (maximum of 20 samples)	Analyte-specific %R and RPD acceptance criteria	1) Evaluate batch 2) Reanalyze or qualify results as necessary	Section Manager/ Laboratory Analyst	Accuracy/Bias (and Precision)
MS/MSD	As indicated on Chain of custody forms, and as required for batch control	Analyte-specific %R and RPD acceptance criteria (NA to air methods or if parent sample concentration ≥4x the spike level)	1) Evaluate MS/MSD to assess matrix interference 2) Evaluate batch and qualify results as necessary	Section Manager/ Laboratory Analyst	Accuracy/Bias and Precision
Surrogate Recovery	Every sample	Surrogate-specific %R acceptance criteria	1) Rerun 2) Reanalyze or qualify results as necessary	Section Manager/ Laboratory Analyst	Accuracy/Bias
QC Elements					
Retention time window position	Once per initial calibration and at the beginning of the analytical shift	All peaks associated with positive results must elute within the established retention time window; for total petroleum hydrocarbon diesel-range organics, the window is determined for carbon ranges.	1) Correct problem 2) Recalibrate instrument 3) Reanalyze results as necessary	Section Manager/ Laboratory Analyst	Analyte Identification

QC Sample	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	MPC
Confirmation column	All positive results must be confirmed	Result not confirmed using second column or detector	1) Analyst must evaluate data to determine if unconfirmed result is a detection 2) Section manager must review analyst's determination	Section Manager/ Laboratory Analyst	Analyte Identification
		Results between primary and second column RPD ≤40%; not required for multicomponent analytes	1) Analyst must select result to report in accordance with method requirements and laboratory SOP 2) Section manager must review analyst's determination	Section Manager/ Laboratory Analyst	Accuracy/Bias

Worksheet 28-2. Method QC Table – Metals

QC Sample	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	MPC
MB	Every preparation batch (maximum of 20 samples)	Analytes not detected >½ LOQ and >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater); no negative values > |LOD|	1) Rerun 2) Evaluate batch 3) Redigest affected samples or qualify results as appropriate	Laboratory Manager/ Laboratory Analyst	Accuracy/Bias and Representativeness
LCS (and LCSD, if performed)	Every preparation batch (maximum of 20 samples)	Analyte-specific %R and RPD acceptance criteria	1) Evaluate batch 2) Reanalyze or qualify results as necessary	Laboratory Manager/ Laboratory Analyst	Accuracy/Bias and Precision
MS (and MSD, if performed)	Every preparation batch (maximum of 20 samples)	Analyte-specific %R and RPD acceptance criteria NA if parent sample concentration ≥ 4x the spike level	1) Evaluate MS/MSD to assess matrix interference 2) Qualify sample results as appropriate	Laboratory Manager/ Laboratory Analyst	Accuracy/Bias and Precision
Laboratory Duplicate (if performed)	Every preparation batch (maximum of 20 samples)	RPD ≤ method criteria if both results >5x the LOQ; absolute difference <LOQ for evaluation of low-level results (<5x LOQ)	1) Evaluate batch 2) Qualify sample results as appropriate	Laboratory Manager/ Laboratory Analyst	Precision
QC Elements					
Serial Dilution	Every preparation batch (maximum of 20 samples)	%D ≤10% for all analytes present in the parent sample at concentrations ≥50x LOQ	1) Evaluate post-digestion spike (PDS) results; if PDS results are in control for all analytes with a serial dilution discrepancy, report data; otherwise: 2) Rerun 3) Evaluate batch 4) Qualify sample results as appropriate	Laboratory Manager/ Laboratory Analyst	Accuracy/Bias
PDS	Every preparation batch (maximum of 20 samples)	%R = 75%-125%	1) Rerun 2) Evaluate batch 3) Qualify sample results as appropriate	Laboratory Manager/ Laboratory Analyst	Accuracy/Bias

QAPP WORKSHEET #29A: PROJECT DOCUMENTS AND RECORDS (MEC)

Project Documents and Records Table

Sample Collection and Field Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Contractor safety forms	Field Staff	FM/PM	Project File
Field logbook and/or daily activity report (DAR; Appendix J, Form M-14)	Field Staff		
Chain-of-Custody forms	Field Staff		
Air bills	Field Staff		
Contractor daily QC reports (Appendix J, Form QC-3)	Field Staff		
Field change requests	SUXOS	PM	
Corrective action reports			
Correspondence		TM/PM	
DGM, Surface and Subsurface MEC Remediation			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Digital field notes / logbook (if used)	Field Team Leaders	UXOQCS QC Geophysicist	Project file/ team document shared portal
Production/Safety/QC daily reports	UXOSO UXOQCS	TM/PM	Project file/ team document shared portal
Three-phase QC inspection forms	UXOQCS QC Geophysicist	CQCM	Project file/ team document shared portal
QC seed item information	UXOQCS QC Geophysicist	QC Geophysicist	Project file/ team document shared portal
DGM data (including maps, target lists, data processing logs, QC data, etc.)	Field Geophysicists	QC Geophysicist	Project file/ team document shared portal
Field data: analog surface clearance, target reacquisition, analog intrusive investigation, DGM-related intrusive investigation	Field Team Leaders	UXOQCS QC Geophysicist	Project file/ team document shared portal
MEC/MPPEH and MDEH tracking form	SUXOS	UXOQCS	Project file/ team document shared portal
Transect summary sheet (analog operations)	SUXOS	UXOQCS	Project file/ team document shared portal

DGM, Surface and Subsurface MEC Remediation (continued)			
MEC disposal checklist	SUXOS	UXOQCS	Project file/ team document shared portal
MDAS tracking form	SUXOS	UXOQCS	Project file/ team document shared portal
RCA, CAR, CAP	UXOQCS QC Geophysicist	CQCM	Project file/ team document shared portal
Field Work Variance	Task Managers	Project Manager	
Project Assessments and Deliverables			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Planning documents	SUXOS/TM	TM/PM	Project file/ team document shared portal
Contractor-Specific Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Training Files	All project team members	TM/PM	The respective team corporate offices, either electronically in an information management system or as hardcopy.

Notes:
Field forms are included in **Appendix J**.

QAPP WORKSHEET #29B: PROJECT DOCUMENTS AND RECORDS (MC)

Project Documents and Records Table

Sample Collection and Field Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Contractor safety forms	Field Staff	FM/PM	Project File
Field logbook and/or DAR	Field Staff		
Chain-of-Custody forms	Field Staff		
Air bills	Field Staff		
Contractor daily QC reports	Field Staff		
Field change requests	FM	PM/Program Chemist	
Corrective action reports			
Correspondence		TM/PM	
Project Assessments and Deliverables			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Planning documents	FM/TM	TM/PM	Project file/team document shared portal
Field audit checklists	Program Chemist	PM/CQCM	Project file
Data verification/validation checklists	Project Chemist	Program Chemist	Project file
Data validation report	Project Chemist	Program Chemist	Project file/team document shared portal
Data usability assessment	Project Chemist	Program Chemist	Project file/team document shared portal
Contractor-Specific Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Training Files	All project team members	TM/PM	The respective team corporate offices, either electronically in an information management system or as hardcopy.
Laboratory Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Laboratory raw data package	Laboratory analyst	Laboratory QAM	Laboratory
Electronic copy of analytical data	Laboratory information technology personnel	Laboratory QAM/Supervisor	Laboratory/KEMRON eDMS/ERPIMS

Laboratory Records (continued)			
Laboratory sample custody log	Laboratory sample custodian	Laboratory QAM/Supervisor	Laboratory
Laboratory equipment calibration logs	Laboratory analyst	Laboratory QAM/Supervisor	Laboratory
Sample preparation logs	Laboratory analyst	Laboratory QAM/Supervisor	Laboratory
Run logs	Laboratory analyst	Laboratory QAM/Supervisor	Laboratory
Sample disposal records	Laboratory sample custodian	Laboratory QAM/Supervisor	Laboratory
Corrective action reports	Laboratory personnel	Laboratory QAM/Supervisor	Laboratory
Correspondence	Laboratory PM	Laboratory Director	Laboratory
Laboratory competency certifications, training and experience records	Laboratory QAM	Laboratory Director	Laboratory

Notes:
Field forms are included in **Appendix J**.

QAPP WORKSHEET #31A, 32A, &33A: ASSESSMENTS AND CORRECTIVE ACTION (MEC)

The three-phase QC inspection process includes preparatory, initial and follow-up QC inspections. Preparatory phase (PP) QC inspections are to be completed before beginning a DFW. Initial phase (IP) QC inspections are to be completed the first time that a DFW is being conducted. Follow-up phase (FP) QC inspections are to be completed as the DFW is ongoing.

Procedures for the three-phase QC inspection process, and procedures for the QC of operations related to the investigation and management of MEC, and other explosives related operations, are located in UXO SOP 9 (**Appendix H**). Procedures for the three-phase QC inspection process and procedures for the QC of geophysical related operations are located in GEO SOP 6 (**Appendix H**).

The table below lists QC inspection information for each DFW. QC operations are an integral part of each task and will be managed by the CQCM, UXOQCS, and the QC Geophysicist (as appropriate), who will work with the field managers to measure project and quality objectives. QC designees other than the identified CQCM, UXOQCS, and QC Geophysicist will be approved by USACE prior to performing QC tasks. MPCs for each DFW are listed in Worksheet #12A. QC inspection checklists for each DFW are at the end of each corresponding SOP (**Appendix H**).

Definable Features of Work:

DFW	Type of Inspection to be Used	Reference	Forms Used	Inspection to be Completed By	Follow-up Phase QC Inspection Frequency	Verify the following	Corrective Action Criteria
Field Data Management	PP, IP, FP inspections. Additional FP inspections as necessary.	DATA SOP 1	PP, IP, FP check sheets, QC surveillance form (Appendix J, Form QC-4), CAR, CAP	CQCM (or designee)	Weekly or as necessary	• Operations are in accordance with the Field Data Management SOP (DATA SOP 1). • Authorize access to QC seed item data as described in the Blind Seed Firewall Plan (**Appendix I**)	• Operations not in accordance with SOP • Authorization access not compliant with Blind Seed Firewall Plan
GIS Data Management	PP, IP, FP inspections. Additional FP inspections as necessary.	DATA SOP 2	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	CQCM (or designee)	Daily or as necessary	Operations are in accordance with the GIS Data Management SOP (DATA SOP 2).	Operations not in accordance with SOP
Field Documentation	PP, IP, FP inspections. Additional FP inspections as necessary.	FIELD SOP 1	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	CQCM (or designee)	Weekly or as necessary	Field Documentation is completed in accordance with the MEC Field Documentation SOP (FIELD SOP 1)	Operations not in accordance with SOP
Land Surveying	PP, IP, FP inspections. Additional FP inspections as necessary.	FIELD SOP 2	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	CQCM (or designee)	Weekly or as necessary	Operations are in accordance with the Land Surveying SOP (FIELD SOP 2).	Operations not in accordance with SOP
Vegetation Removal	PP, IP, FP inspections. Additional FP inspections as necessary.	FIELD SOP 3	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	CQCM (or designee)	Weekly or as necessary	Operations are in accordance with the Vegetation Removal SOP (FIELD SOP 3).	Operations not in accordance with SOP

DFW	Type of Inspection to be Used	Reference	Forms Used	Inspection to be Completed By	Follow-up Phase QC Inspection Frequency	Verify the following	Corrective Action Criteria
IVS Installation and Use	PP, IP, FP inspections. Additional FP inspections as necessary.	GEO SOP 1	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	CQCM (or designee)	Once during IVS installation Weekly or as necessary for IVS use	Operations are completed in accordance with the IVS Installation and Use SOP (GEO SOP 1)	Operations not in accordance with SOP
Blind Seed Item Installation	PP, IP, FP inspections. Additional FP inspections as necessary.	GEO SOP 2 Blind Seed Firewall Plan	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	CQCM (or designee)	Weekly or as necessary	• Operations are completed in accordance with the QC Seed Item Installation SOP (GEO SOP 2). • Integrity of QC seed item data is in compliance with the Blind Seed Firewall Plan	Operations not in accordance with SOP
DGM Data Acquisition	PP, IP, FP inspections. Additional FP inspections as necessary.	GEO SOP 3	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	QC Geophysicist (or designee)	Weekly or as necessary	Operations are completed in accordance with the DGM Data Acquisition SOP (GEO SOP 3)	Operations not in accordance with SOP
DGM Data Processing and Analysis	PP, IP, FP inspections. Additional FP inspections as necessary.	GEO SOP 4	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	QC Geophysicist	Weekly or as necessary	Operations are completed in accordance with the DGM Data Processing and Analysis SOP (GEO SOP 4)	Operations not in accordance with SOP
DGM Target Reacquisition	PP, IP, FP inspections. Additional FP inspections as necessary.	GEO SOP 5	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	QC Geophysicist (or designee)	Weekly or as necessary	Operations are completed in accordance with the DGM Target Reacquisition SOP (GEO SOP 5)	Operations not in accordance with SOP
FCA Installation and Use	PP, IP, FP inspections. Additional FP inspections as necessary.	UXO SOP 1	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	UXOQCS (or designee)	Once during FCA installation Weekly or as necessary for FCA use	Operations are completed in accordance with the FCA Installation and Use SOP (UXO SOP 1)	Operations not in accordance with SOP

DFW	Type of Inspection to be Used	Reference	Forms Used	Inspection to be Completed By	Follow-up Phase QC Inspection Frequency	Verify the following	Corrective Action Criteria
Anomaly Avoidance	PP, IP, FP inspections. Additional FP inspections as necessary.	UXO SOP 2	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	UXOQCS	Weekly or as necessary	Operations are completed in accordance with the Anomaly Avoidance SOP (UXO SOP 2)	Operations not in accordance with SOP
Intrusive Investigation using Analog Methods	PP, IP, FP inspections. Additional FP inspections as necessary.	UXO SOP 3	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	UXOQCS	Weekly or as necessary	Operations are completed in accordance with the Intrusive Investigation using analog methods SOP (UXO SOP 3)	Operations not in accordance with SOP
Intrusive Investigation of DGM Targets	PP, IP, FP inspections. Additional FP inspections as necessary.	UXO SOP 4	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	UXOQCS	Weekly or as necessary	Operations are completed in accordance with the Intrusive Investigation of DGM Targets SOP (UXO SOP 4)	Operations not in accordance with SOP
MEC and MPPEH Management	PP, IP, FP inspections. Additional FP inspections as necessary.	UXO SOP 5	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	UXOQCS	Daily or as necessary	Operations are completed in accordance with the MEC and MPPEH Management SOP (UXO SOP 5)	Operations not in accordance with SOP
Demolition of MEC and MPPEH	PP, IP, FP inspections. Additional FP inspections as necessary.	UXO SOP 6	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	UXOQCS	Per event or as necessary	Operations are completed in accordance with the Demolition of MEC/MPPEH and MDEH SOP (UXO SOP 6)	Operations not in accordance with SOP
Explosives Management	PP, IP, FP inspections. Additional FP inspections as necessary.	UXO SOP 7	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	UXOQCS	Weekly or as necessary	Operations are completed in accordance with the Explosives Management SOP (UXO SOP 7)	Operations not in accordance with SOP

DFW	Type of Inspection to be Used	Reference	Forms Used	Inspection to be Completed By	Follow-up Phase QC Inspection Frequency	Verify the following	Corrective Action Criteria
Explosives Siting/ Exclusion Zones	PP, IP, FP inspections. Additional FP inspections as necessary.	UXO SOP 8	PP, IP, FP check sheets, QC surveillance form, CAR, CAP	UXOQCS	Per event or as necessary	Operations are completed in accordance with the Explosives Siting/EZ SOP (UXO SOP 8)	Operations not in accordance with SOP

QAPP WORKSHEET #31B, 32B, &33B: ASSESSMENTS AND CORRECTIVE ACTION (MC)

An audit evaluates the capability and performance of a measurement system or its components and identifies problems warranting corrective action. Both field and laboratory activities will be audited by QA assessment/oversight personnel. Audits will be conducted at random or at scheduled intervals by the KEMRON QA/QC officer or qualified senior technical staff person. These audits do not include the checks conducted by USACE personnel during project oversight.

The auditor will develop a written audit plan or checklist to provide a basis for each audit. Audits may review adherence to project plans, training status, health and safety procedures, activity performance and records, QC data, equipment calibrations, conformance to SOPs, and compliance with applicable laws, regulations, policies, and procedures.

Appropriate corrective action procedures will be implemented in response to any problems encountered during the field assessment so that problems do not go unresolved. If deficiencies are identified during an audit, the auditor will prepare a Non-Routine Occurrence Report (NRO) or its equivalent and issue a corrective action request to identify and schedule specific corrective actions to be undertaken and completed. USACE personnel will document corrective actions on Engineer (ENG) Form 6048. These forms require a response within time limits established by the criticality of the deficiency. Examples forms are **Appendix J**. Completion of corrective actions will be verified by the auditor. After acceptance and verification of all corrective actions, an audit report will be used to document closure of the audit.

Oversight of QA activities will be performed through the use of audits. The following table presents the types of audits and their frequency. Corrective action procedures will be taken as appropriate in response to problems identified in the field or in the laboratory. A performance audit is a review of the existing project and QC data to determine the accuracy of a total measurement system or a component of the system. Laboratory performance audits can be conducted routinely by USACE, KEMRON or a data validation contractor. This type of audit may consist of analysis of one or more performance testing (PT) samples or a telephone response audit. All assessments will be submitted to the PM and will be maintained in the project files.

Assessments

Assessment Type	Responsible Personnel and Organization	Number and Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Review of Work Plan, SOPs, and SSHP with Field Staff	FM PM	Before sampling startup and with all new field staff prior to assignment	January 2018	Completed acknowledgment signature pages	48 hours following assessment
Laboratory Systems Audit	Program Chemist	As requested by QC Manager or in the event of corrective action failure	NA	Audit Report	90 days after audit
Laboratory Assessment for Appropriate Certifications, Capacity, and QAPP Review with Staff	Program Chemist	Before sampling mobilization, as new laboratories are contracted	January 2018	Receipt of copies of certifications. E-mail traffic concerning lab capacity before sampling startup. QAPP sign-off sheet received from laboratory.	48 hours following assessment
Quality field control audit	FM	Daily during sampling event	August 2017 through October 2017	DAR	End of day
Laboratory performance audit (QA split/PT sample)	USACE Program Chemist	As required by performance evaluation program	NA	Performance Report	90 days after audit
Work performed in accordance with QAPP	FM Project Chemist	Ongoing during all phases of fieldwork	January 2018 through April 2018	DAR	24 hours following conclusion of business day
Logbook and Field Form Review	FM	Daily	January 2018 through April 2018	NA; corrections will be made directly to reviewed documents	24 hours following assessment
Tailgate Safety Meeting	FM	Daily	January 2018 through April 2018	Verbal debriefing and daily sign-off log. If a safety incident occurs, a Supervisor Injury Employee Report is completed.	Weekly; any safety incidents will be reported to the PM and Corporate Health and Safety Officer immediately

Assessment Type	Responsible Personnel and Organization	Number and Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Field Sampling and Chain of Custody Form Review Against QAPP Requirements	Sample Coordinator	Daily	January 2018 through April 2018	Corrections will be made directly to reviewed documents; communication may be in the form of email	24 hours following assessment
Data Validation	Project Chemist	Per sample delivery group	June 2018	Communication may be in the form of email traffic clarification of the analytical report or corrective actions because of deficiencies identified in the validation process.	24 hours following assessment
Laboratory Report Deliverables and Analytical Results Against QAPP Requirements	Project Chemist	As discrepancies are identified in the validation process	June 2018	Memorandum or e-mail to PM and Program Chemist	72 hours following assessment

Assessment Response with Corrective Actions:

Assessment Type	Individual(s) Notified of Findings	Assessment Response Documentation	Time Frame for Response	Responsibility for Implementing CA	Responsibility for Monitoring CA
Review of QAPP, SOPs, and Site Safety and Health Plan with field staff	PM CQCM	Completed acknowledgement signature pages	48 hours following assessment	FM Project or Program Chemist	PM Technical Reviewer
Laboratory Systems Audit	Laboratory PM PM	Completed acknowledgement signature pages	60 days from date of audit report	Laboratory PM	Program Chemist
Work performed in accordance with QAPP	PM	Interim corrective action documented pending final approval	By close of same business day	FM	PM and CQCM
Logbook and Field Form Review	PM	Corrections will be made directly to reviewed documents	NA	FM	PM
Laboratory Assessment for Appropriate Certifications, Capacity, and QAPP Review with Staff	Program Chemist	Response to email or memorandum	48 hours after notification	Laboratory PM and Project Chemist	Program Chemist
Tailgate Safety Meeting	PM	Included as part of the process of the Supervisor Injury Employee Report	24 hours after notification	FM	Corporate Health and Safety Manager

QAPP WORKSHEET #34A: DATA VERIFICATION AND VALIDATION INPUTS (MEC)

This worksheet lists the inputs that will be used during data verification and validation. Inputs include planning documents, field records, and geophysical analysis records.

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Contract	X	
2	Approved MEC and MC UFP-QAPP	X	
3	Laboratory SOPs	X	
4	Field SOPs	X	
5	Explosive Site Plan (ESP)	X	
Field Records			
6	DAR	X	X
7	Field Data Forms (digital)	X	X
8	Daily Safety Report	X	X
9	Daily QC Report	X	X
10	DGM Survey and QC Data (including IVS Report, IVS Data and QC seed item data)	X	X
11	Intrusive investigation data	X	X
12	MEC data	X	X
13	RCAs and CARs	X	X

The three phase QC inspection methods described in GEO SOP 6 and UXO SOP 9 will be used by QC personnel to assess and document project quality.

QAPP WORKSHEET #34B: DATA VERIFICATION AND VALIDATION INPUTS (MC)

This worksheet lists the inputs that will be used during data verification and validation. Inputs include planning documents, field records, and laboratory records. All laboratory data will be subjected to two levels of data review: data verification and data validation. Data verification is a check that all specified activities involved in collecting and analyzing samples/data have been completed and documented and that the necessary records (objective evidence) are available to proceed to data validation. Data validation is the evaluation of conformance to stated requirements, including those in the contract, methods, SOPs, ESP and the QAPP. Laboratory data reduction, review, and reporting procedures and project data management activities will produce complete documentation, minimize transcription and reporting errors, and provide proper review and qualification of laboratory data. All laboratory reports and supporting documentation will be reviewed to verify and validate the laboratory data. The table below provides examples of records subject to verification and validation. A more rigorous data validation, full data validation, will be conducted at the discretion of the PM.

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Contract	X	
2	Approved MEC and MC UFP-QAPP	X	
3	Laboratory SOPs	X	
4	Field SOPs	X	
5	Explosive Site Plan (ESP)	X	
Field Records			
6	DAR	X	X
7	Field Data Forms (digital)	X	X
8	Daily Safety Report	X	X
9	Daily QC Report	X	X
13	COC forms	X	X
14	Audit reports	X	X
15	Field notes/logbook	X	X
16	Sampling locations, number of samples	X	X
Analytical Data Package			
17	Cover Sheet	X	X
18	Table of Contents	X	X
19	Case Narrative	X	X
20	Analytical Results	X	X
21	Sample Management Records	X	X
22	QA/QC Summary Information	X	X
23	List of Project-Specific Analytes	X	X
24	Information for Third-Party Review		X
25	LOD/LOQ establishment and verification	X	X
26	Project-specific PT sample results	X	X
27	Electronic data deliverable	X	X

Notes:
[1]The laboratory data deliverables (items 8 through 15) will conform to the deliverable requirements outlined in Appendix A of the DoD QSM (DoD, 2017)

QAPP WORKSHEET #35A: DATA VERIFICATION PROCEDURES (MEC)

This worksheet documents procedures that will be used to verify project data. It applies to both field and digital data. Data verification is a completeness check to confirm that all required activities were conducted, all specified records are present, and the contents of the records are complete.

Records Reviewed	Requirement Documents	Process Description	Responsible Person
DAR	QAPP	Verify that DAR forms are present and complete for each day of field activities. Very that all activities (including QC) are documented. Verify that changes to equipment / personnel / operations are documented and were reported in accordance with required standards.	CQCM, UXOQCS, QC Geophysicist
Field Data Forms (digital)	QAPP	Verify that data for each form have been filled out properly and are complete.	UXOQCS, QC Geophysicist
Daily Safety Reports	QAPP, APP	Verify that all planned safety audits were conducted. Review safety audit surveillances, inspections and reports. If deficiencies are noted verify that corrective action was implemented according to the CAR (and CAP if generated) that was generated for each deficiency / non-conformance.	UXOSO
Daily QC Reports	QAPP	Verify that all planned QC audits were conducted. Review QC audit surveillances, inspections, checklists and reports. If deficiencies are noted verify that corrective action was implemented according to the CAR that was generated for each deficiency / non-conformance.	PM
DGM Survey and QC Data	QAPP	Verify that the DGM operation (system) met the performance criteria for all days that DGM data was collected. Verify that all DGM data meets requirements in the QAPP. Verify that all DGM IVS metrics described in Worksheet #12A have been met and that all QC seed items have been located within metrics described in Worksheet #12A. Failure to meet any established MPC will result in the failure of the associated dataset submittal and require rework of that dataset or additional data acquisition to meet the MPC requirements.	QC Geophysicist
Intrusive Investigation Data	QAPP	Verify that the intrusive investigation data has been filled out properly and is complete.	UXOQCS
MEC Data	QAPP	Verify that all recovered MEC items are documented in the KEMRON database, including final disposition and date destroyed.	UXOQCS
RCA and CARs	QAPP	Verify that corrective actions were implemented for each deficiency/non-conformance noted according to the CAR.	CQCM

QAPP WORKSHEET #35B: DATA VERIFICATION PROCEDURES (MC)

This worksheet documents procedures that will be used to verify project data. It applies to both field and digital data. Data verification is a completeness check to confirm that all required activities were conducted, all specified records are present, and the contents of the records are complete.

Records Reviewed	Requirement Documents	Process Description	Responsible Person
Methods	QAPP and Analytical Method SOP[1]	Records support implementation of the SOP sampling and analysis.	Project Chemist
Performance requirements		Verify laboratory method SOPs are sufficient to satisfy DQOs.	Program Chemist
Sampling locations, number of samples		Verify that sample locations and quantities will be sufficient to satisfy DQOs.	Program Chemist
DAR and other field documentation		Review daily sampling activity reports including pertinent field sampling data.	Project Chemist
COC		Examine traceability of data from sample collection to generation of project reported data.	Project Chemist
Deviations		Determine impacts of any deviations from methods.	Program Chemist
Sensitivity		Verify that LODs and LOQs are achieved as outlined in the QAPP and that the laboratory successfully analyzed a standard at the LOD.	Project Chemist
Precision		Review data against performance criteria and determine impact of any result out of criteria.	Project Chemist
Accuracy		Review data against performance criteria and determine impact of any result out of criteria.	Project Chemist
QC samples		Ensure that a sufficient number of QC samples are analyzed, as outlined in the QAPP, to meet DQOs.	Project Chemist
Field Change Request/Corrective Action Report	Field SOPs[2]	Review any change request or corrective action documentation. Determine impact to project objectives.	Project/Program Chemist
Electronic data deliverables (EDDs)	QAPP and PBR Statement of Objectives	Verify that acceptable EDDs have been submitted and qualified. The staged electronic data deliverable format files will be submitted to USACE.	Project Chemist

QAPP WORKSHEET #36A: DATA VALIDATION PROCEDURES (MEC)

This worksheet documents procedures that will be used to validate the overall approach to anomaly detection and intrusive investigation and evaluate conformance to the requirements in the contract, SOPs, and the QAPP. The validation approach involves testing the processes and thresholds for anomaly detection, reacquisition, and resolution through the placement of blind QC seed items throughout the investigation area prior to geophysical survey and intrusive investigation activities to confirm that the seed items can be correctly detected, located, and recovered. In addition to the blind seeding program, the following data validation procedures will be performed.

Records Reviewed	Inputs	Process Description	Responsible for Validation
DGM Survey and QC Data	QAPP GEO SOP 1 GEO SOP 3 GEO SOP 4 GEO SOP 6 UXO SOP 2	Validate that the DGM survey and QC data (including the IVS report, IVS data, and blind seed item data) conform to requirements. If all IVS and blind seed item MPC are met, then the data has been verified and validated and is usable.	QC Geophysicist UXOQCS
Intrusive Investigation Data	QAPP GEO SOP 5 UXO SOP 1 UXO SOP 3 UXO SOP 4 UXO SOP 9	Validate that all intrusive investigation data conform to requirements.	UXOQCS
MEC Data	QAPP UXO SOP 5 UXO SOP 6 UXO SOP 9	Validate that all data relating to MEC conform to requirements.	UXOQCS

QAPP WORKSHEET #36B: DATA VALIDATION PROCEDURES (MC)

An electronic and manual data review of the uploaded laboratory ERPIMS EDD and the hard-copy report will be conducted for routine data validation. The data validation SOP, PR-TC-04.01.00.00, is included in **Appendix H**. Data will be uploaded to a centralized database to accomplish the electronic validation. Data will be validated based on the most current versions of EPA National Functional Guidelines and the DoD QSM. The validated data will be labeled as S2BVEM as outlined in *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA, 2009). The resulting output files, containing data validation flags, will be reviewed by the Project Chemist. Any necessary manual additions or changes to the qualifiers will be made at that time. In addition to the routine validation procedure described above, three other types of data validation will occur. A stage 2A validation, electronic (S2AVE) will be conducted on waste analysis; and a more rigorous data validation, stage 4 validation, electronic and manual (S4VEM), will be conducted on a minimum of data at the discretion of the PM.

Analytical Group/Method	Explosives	Metals
Data deliverable requirements	Enhanced ERPIMS	Enhanced ERPIMS
Analytical specifications	Worksheet #28	Worksheet #28
Measurement performance criteria	Worksheet #12B	Worksheet #12B
Percent of screening data to be validated	100% Completeness check (S1VM)	100% Completeness check (S1VM)
Percent of waste samples to be validated	100 % (S2AVE)	100 % (S2AVE)
Percent of definitive data packages to be validated	100% (S2BVEM)	100% (S2BVEM)
Percent of definitive raw data reviewed	As requested (S4VEM)	As requested (S4VEM)
Percent of definitive results to be recalculated	As requested (S4VEM)	As requested (S4VEM)
Validation procedure	National Functional Guidelines[1]	National Functional Guidelines[1]
Definitive validation code	S2BVEM	S2BVEM
Electronic validation program	eDMS	eDMS

Notes:
[1] National Functional Guidelines (EPA, 2017a and EPA, 2017b)
S2A, S2B, S4 = stages as outlined in the labeling guidance document Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA, 2009).
VEM = Validation_Electronic_And_Manual as outlined in the labeling guidance document *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA, 2009).

QAPP WORKSHEET #37: DATA USABILITY ASSESSMENT

This worksheet documents procedures that will be used to perform the data usability assessment and involves a qualitative and quantitative evaluation of the collected data to determine if the project data are of the right type, quality, and quantity to support the decisions that need to be made. It involves a retrospective review of the systematic planning process to evaluate whether underlying assumptions are supported, sources of uncertainty have been managed appropriately, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence.

The entire project team is responsible for assessing whether the data meet the project objectives. The project team will make every effort to identify any critical elements or trends that would result in non-usability of data as early as possible. The project team responsible for participating in the data usability assessment preparation or review is listed below:

Name	Title	Organization	Role in Usability Assessment
Rick Smith	Project Manager	USACE Project Team	Reviewer
Frank Roepke	Task Manager	USACE Project Team	Reviewer
Mike Slavens	OESS	USACE Project Team	Reviewer
Eric Kirwan	QA Geophysicist	USACE Project Team	Reviewer
Dan Burnett	Project Manager	KEMRON	Preparation
Teresa Hardy	Task Manager	Gilbane	Preparation
Jerry Grose	MEC Remediation Manager	Gilbane	Preparation
TBD	UXOQCS	KEMRON	Preparation
Andy Gascho	Project Geophysicist	Gilbane	Preparation
Alex Mussio	QC Geophysicist	KEMRON	Preparation
Evelyn Dawson	Program Chemist	Gilbane	Preparation

The following documents and data will be used as input to the data usability assessment.

- QAPP
- Contract specifications
- Daily/Weekly QC reports and QC inspection forms/data
- CARs
- IVS report
- IVS data
- QC seed item data.

The data usability report will be included as an appendix to the Final Remedial Investigation Report. Worksheets #37A and #37B identify the steps used in performing the data usability assessment.

QAPP WORKSHEET #37A: DATA USABILITY ASSESSMENT (MEC)

Step 1	**Review the project's objectives and sampling design** The goal this project is to conduct a MEC RI to characterize the nature and extent of potential MEC and MD contamination within the AOI North of Castner Range, to prepare an FS to present remedial action alternatives by which to address the findings of the RI, and to achieve stakeholder acceptance of a Proposed Plan (PP) and Decision Document (DD) to guide potential future remediation efforts. To that end, the usability assessment will incorporate the activities listed below. **Field Certification** Field personnel will generate field forms, maps, and notes describing the daily procedures. The DAR, generated during daily fieldwork, will discuss any successes and/or deviations from the work plan. An example DAR is included with the field forms provided in **Appendix J**. The UXOQCS will review all field documentation as it is generated for consistency and errors. Any anomalies identified will be discussed with the project team to determine if any changes to the QAPP are needed. Any changes will be documented on a field change request form.
Step 2	**Review the data verification and data validation outputs** The outputs from the verification and validation process will be used to determine usability; QA reports. Data will be summarized as necessary using graphs, maps, and/or tables. Personnel at all levels will generate data and documentation that will be reviewed to identify trends, relationships, and/or anomalies in the dataset.
Step 3	**Verify the assumptions of the selected statistical method** Site-specific assumptions of the dataset will be discussed; formulas used to evaluate site-specific data will be reviewed.
Step 4	**Implement the statistical method** The precision and accuracy of the entire dataset is used to determine if any systemic problems have occurred during the fieldwork that will result in deficiencies in the dataset. The occurrence of systemic problems and the resulting consequences will be discussed with the project team.
Step 5	**Document data usability and draw conclusions** The entire project team is responsible for assessing whether the data meet the performance objectives outlined in DQO #1. The project team will determine if the data can be used as intended, considering implications of deviations and corrective actions. The project team will then assess the performance of the dataset design and identify any limitations on data use, and update the CSM and document conclusions. The conclusions will be discussed in the final report and the data validation report (DVR).

QAPP WORKSHEET #37B: DATA USABILITY ASSESSMENT (MC)

Step 1	**Review the project's objectives and sampling design** The goal for DQO #2 activities is to IS and biased spoke-and-hub to determine the presence, nature, and characterize the nature and extent of MC contamination within the AOI North of Castner Range above Texas residential PCLs; to prepare an FS to present remedial action alternatives by which to address the findings of the RI; to support human health and ecological risk assessments; and, to achieve stakeholder acceptance of a PP and DD to guide potential future remediation efforts. To that end, the usability assessment will incorporate the activities listed below. **Field Certification** Field personnel will generate field forms, maps, and notes describing the daily procedures. The DAR, generated during sampling, will discuss any successes and/or deviations from the work plan. An example DAR is included with the field forms provided in **Appendix J**. The Field Team Leader will review all field documentation as it is generated for consistency and errors. Any anomalies identified will be discussed with the project team to determine if any changes to the sampling design are needed. Any changes will be documented on a field change request form. **Data Quality Indicator Review** PARCCS parameters will be used to help identify deficiencies in the sample data that would affect the achievement of the project DQOs. Laboratory limits and QC samples will be used as part of the PARCCS assessment to detect anomalies in the dataset. In addition, the laboratory will create trend charts to track variability in laboratory processes and establish in-house precision and accuracy criteria. Laboratory limits used in the sensitivity review consists of the DL, LOD, and LOQ. Laboratory QC samples consist of method blanks, LCSs, MS/MSD samples, surrogates, and laboratory replicates. All samples will be spiked with surrogate compounds where recommended or required by the method. For inorganic analyses, a method blank, LCS, MS, and laboratory or duplicate will be analyzed for each analytical batch. **Precision** Precision will be evaluated through the analysis of field duplicate samples, LCS and LCSD (if LCSD is run), and MS/MSD samples. The duplicate sample will not be re-analyzed when the RPD criteria are not met. Discussion of QC failures will be documented in the laboratory case narrative. The Project Chemist will work with the laboratory to determine the cause of the failure and to determine if any of the QC failures are due to matrix or sampling error and if the failures have an impact on the project objectives. For the MS and the MSD, sample heterogeneity and the presence of interfering compounds often negatively affect the precision of the analysis. Also, the presence of high levels of target compounds in the sample chosen for spiking may necessitate a dilution of the sample, or may otherwise result in errors in spiked compound recovery. For these reasons, MS samples may not be truly representative of the precision of the analytical process. When the RPD obtained from the results of MS/MSD are out of criteria and the RPD of the LCS/LCSD is within criteria, the poor variance is attributed to the matrix of the sample and the effect on the project objectives has to be considered. The precision criteria for spiked samples are listed in Worksheet #12B.

For this project, the goal for precision of field duplicates is listed in Worksheet #12B. In the event that both of the duplicate sample results are less than the LOD, the RPD will not be calculated and the variance of the LCS/LCSD will be used as the determinant of precision for the batch.

Accuracy
Accuracy will be evaluated by the percent recovery of the spiked compounds in the LCS, MS, surrogates, and proficiency samples (if required). LCS, MS, and surrogates will be spiked before extraction. Worksheet #12B presents accuracy goals for this investigation based on the percent recovery of MS, LCS, and surrogate spikes. The data reviewer will use the accuracy results to help determine if any of the QC failures are due to matrix or sampling error and if the failures have an impact on the project objectives.

For the MS and the MSD, sample heterogeneity and the presence of interfering compounds often negatively affect the accuracy of the analysis. Also, the presence of high levels of target compounds in the sample chosen for spiking may necessitate a dilution of the sample, or may otherwise result in errors in spiked compound recovery. For these reasons, MS samples may not be truly representative of the accuracy of the analytical process. When the percent recovery obtained from the results of MS are out of criteria and the percent recovery of the LCS is within criteria, the bias is attributed to the matrix of the sample and no corrective action will be required; however, the effect on the project objectives has to be considered. Discussion of laboratory QC failures will be documented in the laboratory case narrative. The project chemist will work with the laboratory to determine the cause of the failure and to determine if any of the QC failures are due to matrix or sampling error and if the failures have an impact on the project objectives.

Representativeness
Representativeness as it relates to field procedures refers to collecting samples that allow accurate conclusions to be made regarding the composition of the sample media at the entire site. Representativeness will be qualitatively assessed by evaluating whether the procedures described in this QAPP were followed.

Laboratory procedures will be reviewed to verify that SOPs were followed and method requirements were met during the analysis of project samples. Laboratory sample storage practices, laboratory-generated rinse water, holding times, sub-sampling procedures, and method blanks will be assessed for potential impacts on the representativeness of the data. Data determined to be non-representative will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

Completeness
When data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation. The evaluation of completeness will help determine whether any critical deficiencies identified during the validation process resulted in non-attainment of project objectives. The procedures and determined impact on the sample results will be used to assess if any problems along the data path will render the decision-making process unreliable and the dataset incomplete.

Comparability
For results to be comparable, oversight by experienced team members will ensure that the procedures are conducted in a manner to meet the project objectives. Any deviation from field or laboratory methods will be documented on a change request form. The project team

	will review the change request to determine if the change will impact the comparability of the data. **Sensitivity** The LOD and LOQ will be evaluated after sample analysis to determine if there were any matrix effects, operator errors, or analytical process errors that interfered with the ability to compare the results to the PALs. The LOD will be used to determine if no detectable amounts of contaminants of concern are present. If no detectable amounts are reported and all data are acceptable from the verification and validation, then the data are usable. The DL will be used to determine if any detectable amounts of contaminants of concern are present. If detectable amounts are reported and the verification and validation are acceptable, then the data are usable. Any detection falling between the DL and LOQ are qualified as estimated. If anomalies in sensitivity are present, the rationale for use or non-use of the affected samples will be discussed in the data validation report (DVR). Worksheet #15 presents the laboratory LODs and LOQs for the selected analytical method(s) used to support the project decision limits. The laboratory DLs are presented in **Appendix G**.
Step 2	**Review the data verification and data validation outputs** The outputs from the verification and validation process will be used to determine usability; QA reports, including the automated data validation reports and DARs will be reviewed. Data will be summarized as necessary using graphs, maps, and/or tables. Personnel at all levels will generate data and documentation that will be reviewed to identify trends, relationships, and/or anomalies in the dataset.
Step 3	**Verify the assumptions of the selected statistical method** Site-specific assumptions of the dataset will be discussed; formulas used to evaluate site-specific data will be reviewed.
Step 4	**Implement the statistical method** For each analytical method, the laboratory uses the MS/MSD and LCS/LCSD data to track and analyze trends in the laboratory. From these trends they can recognize deficiencies in the method and create in-house acceptance criteria. For this project, the limits are based on the most recent version of the DoD QSM, if available. For methods where the limits are not available, the project criteria default to the laboratory criteria based on their tracked trending. The precision and accuracy of the entire dataset is used to determine if any systemic problems have occurred during the sampling event that will result in deficiencies in the dataset. The occurrence of systemic problems and the resulting consequences will be discussed in the DVR.
Step 5	**Document data usability and draw conclusions** The entire project team is responsible for assessing whether the data meet the performance objectives outlined in DQO #2. The project team will determine if the data can be used as intended, considering implications of deviations and corrective actions. The project team will then assess the performance of the sampling design and identify any limitations on data use, and update the CSM and document conclusions. The conclusions will be discussed in the final report and the DVR. If the data indicate anomalies, the impacted data will be qualified as described in the current National Functional Guidelines. The impact will be documented along with the rationale for re-sampling or limited use of the data.

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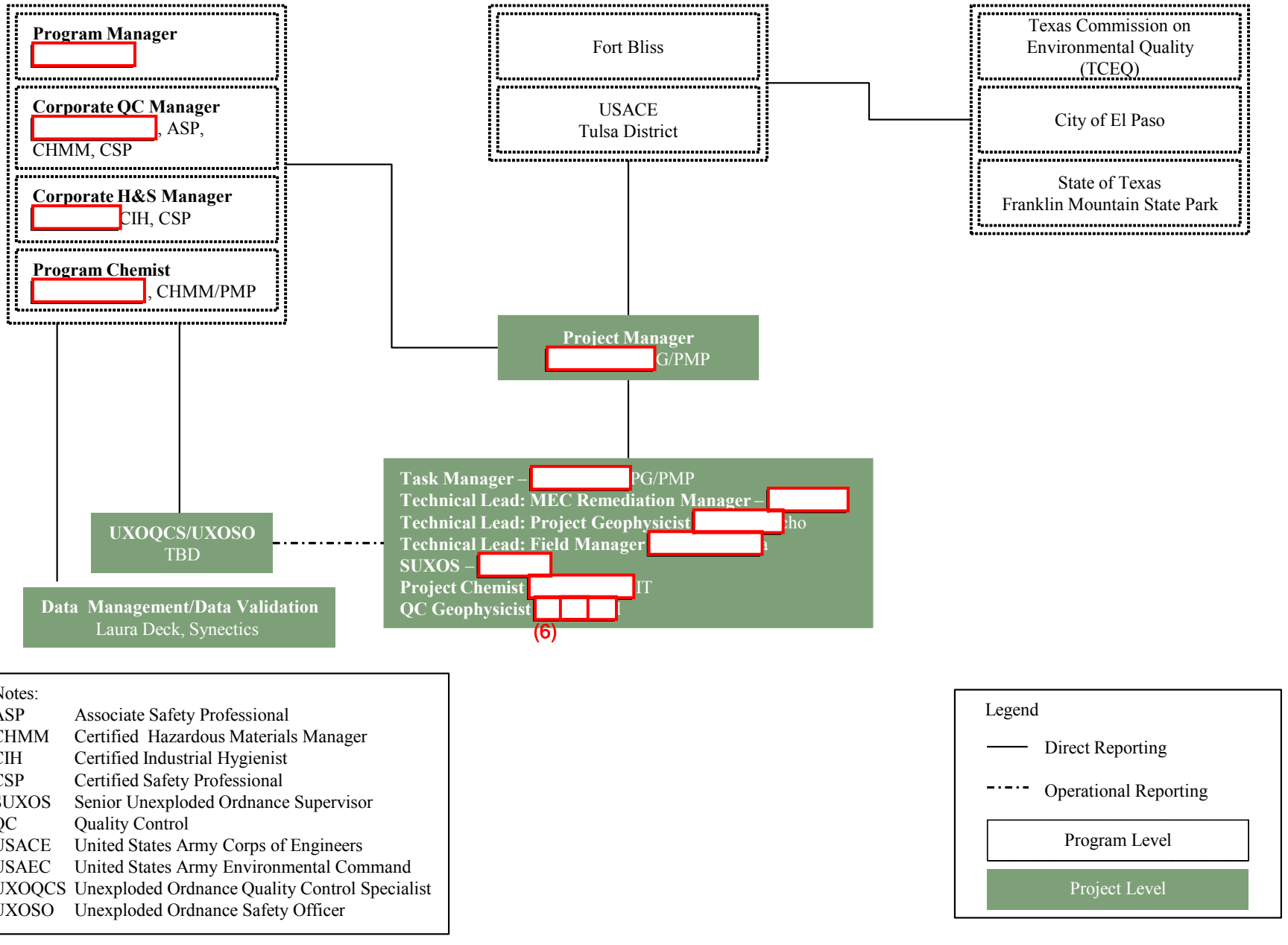
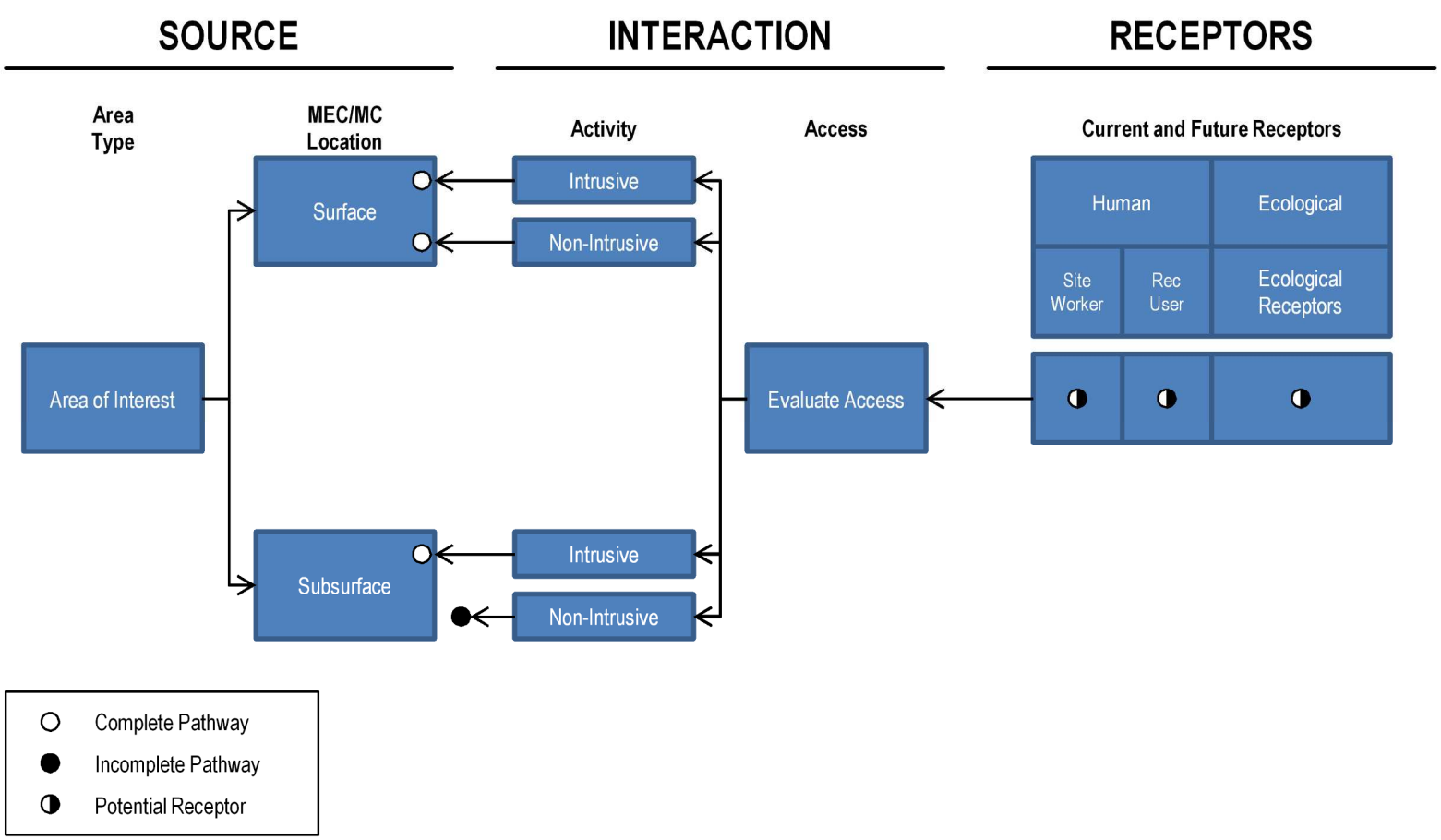
FIGURES



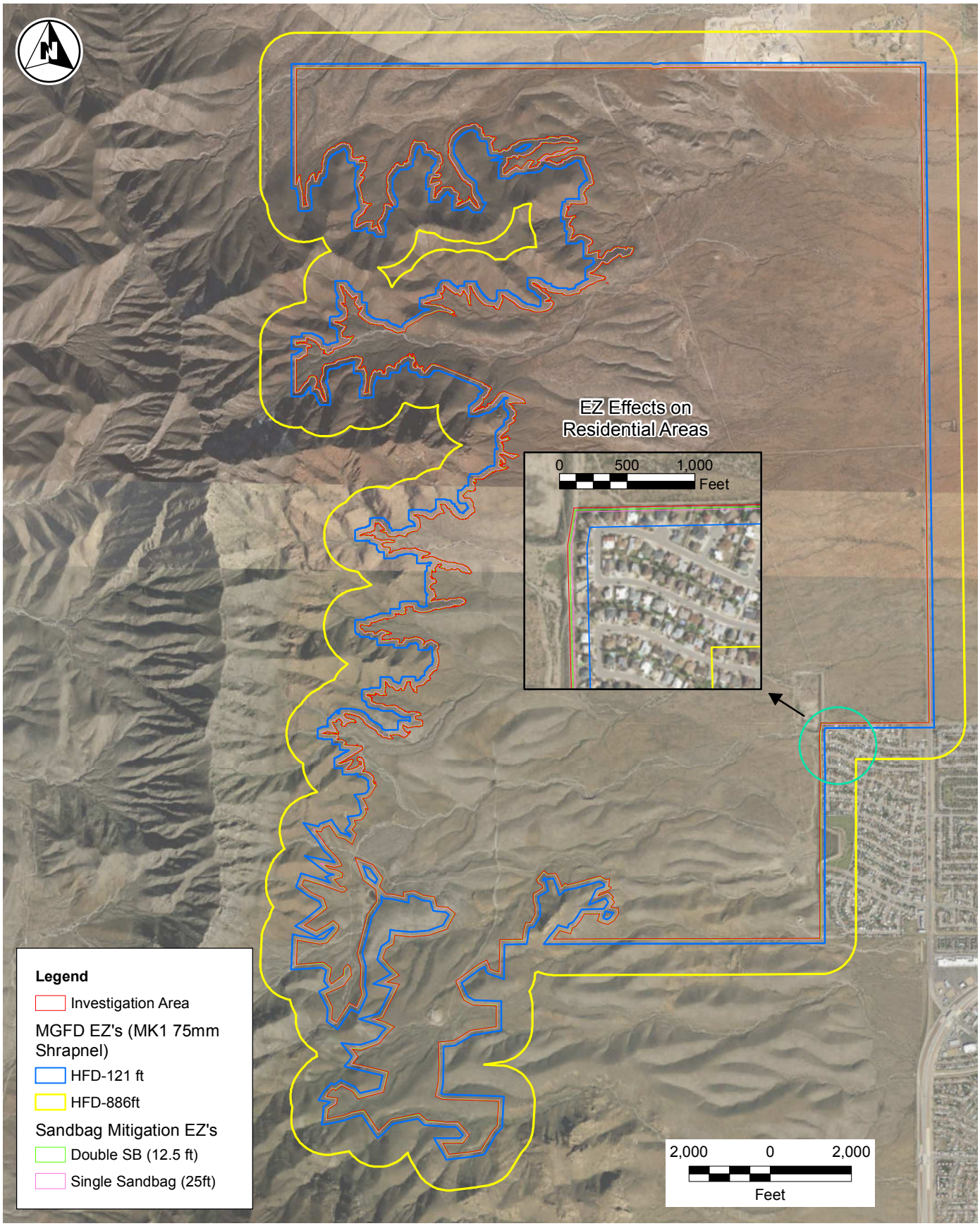
Area of Interest North of Castner Range
USACE - Tulsa District
El Paso, Texas

Figure 1-1
Organization Chart
Quality Assurance Project Plan



Area of Interest North of Castner Range
USACE - Tulsa District
El Paso, Texas

Figure 2-1
Conceptual Site Model
Quality Assurance Project Plan



Area of Interest North of Castner Range
USACE - Tulsa District
El Paso, Texas

Figure 2-2
Investigation Area
Historical Records Review

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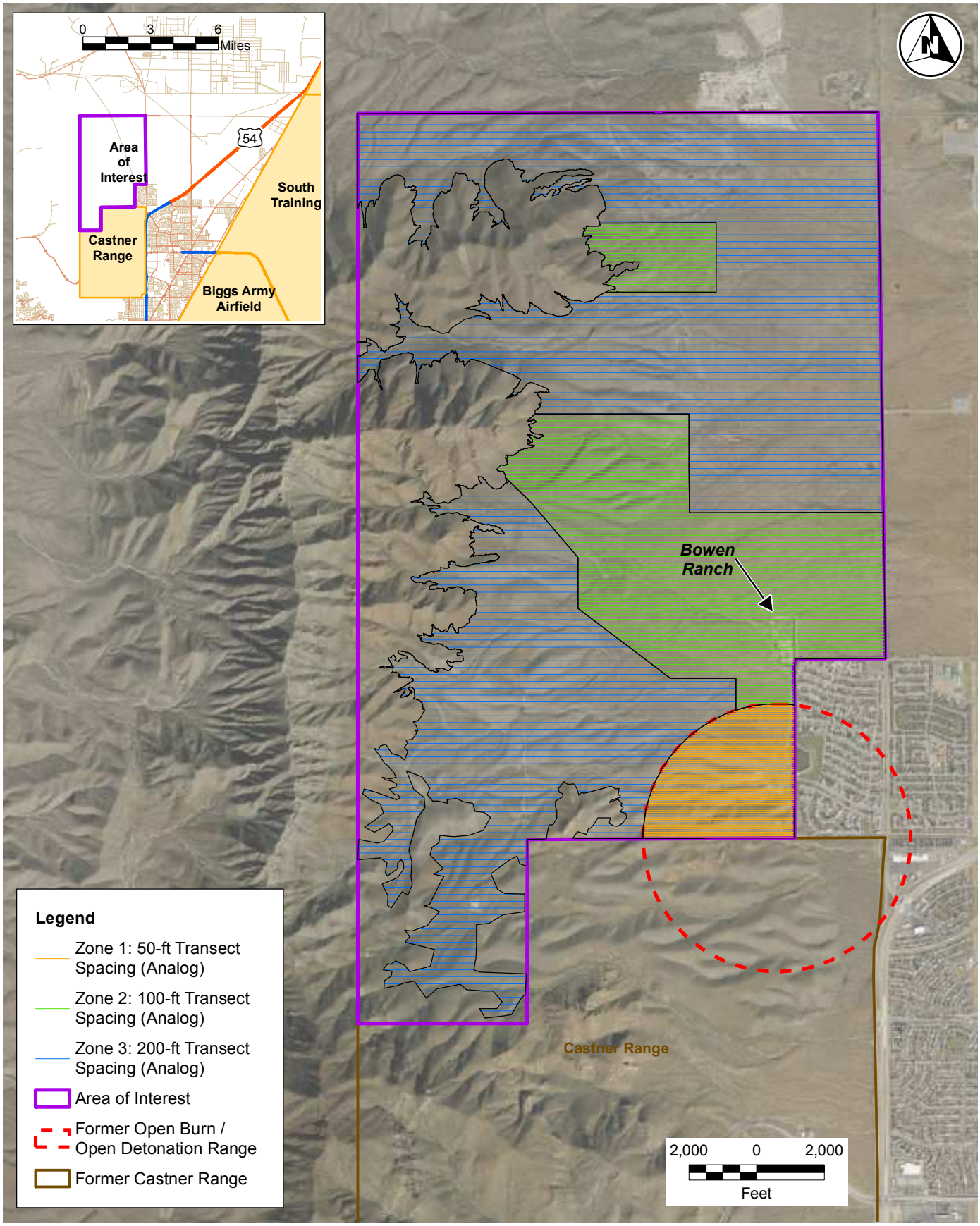
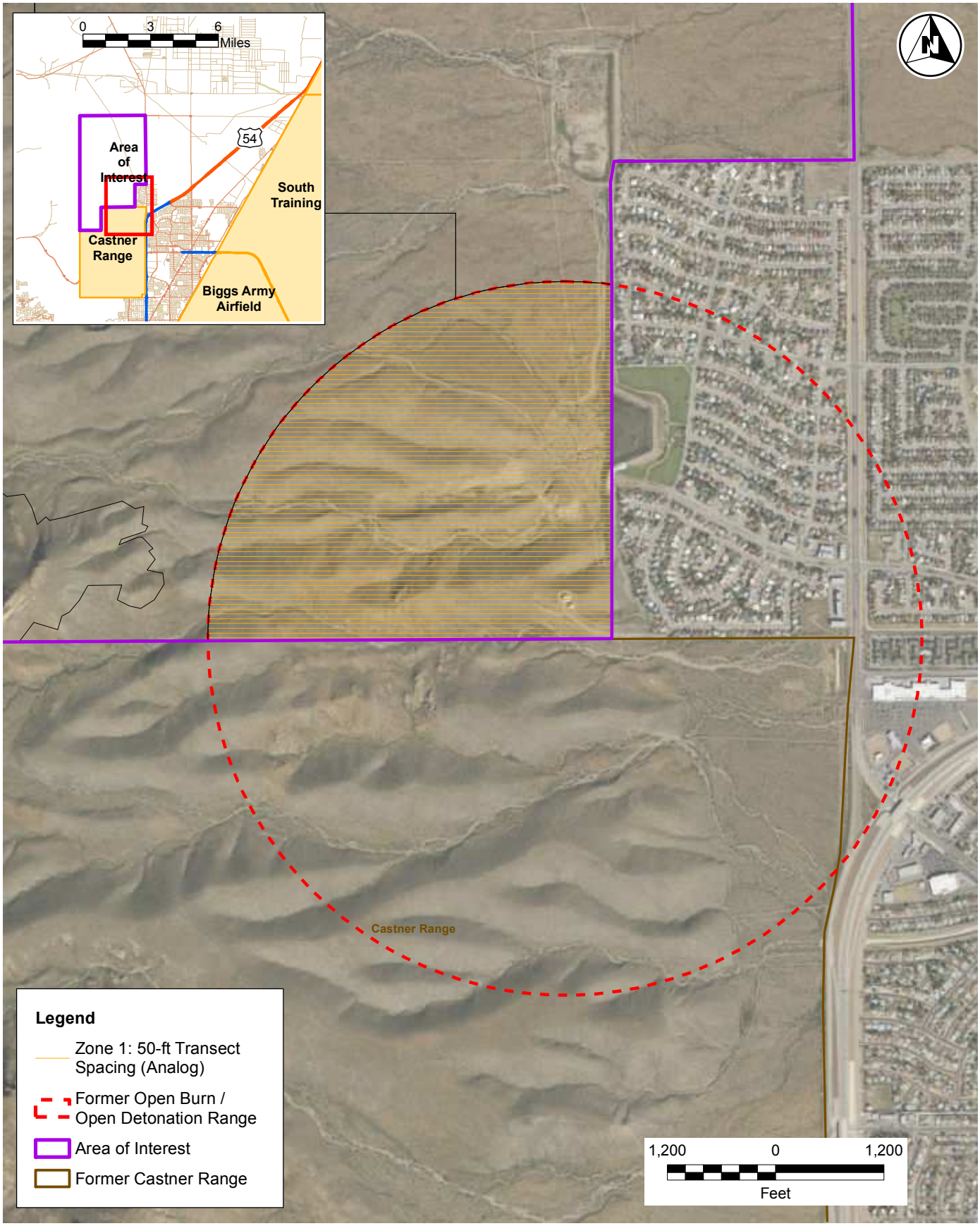


Area of Interest North of Castner Range
USACE - Tulsa District
El Paso, Texas

Figure 2-3
Transect Investigation Zones
Quality Assurance Project Plan

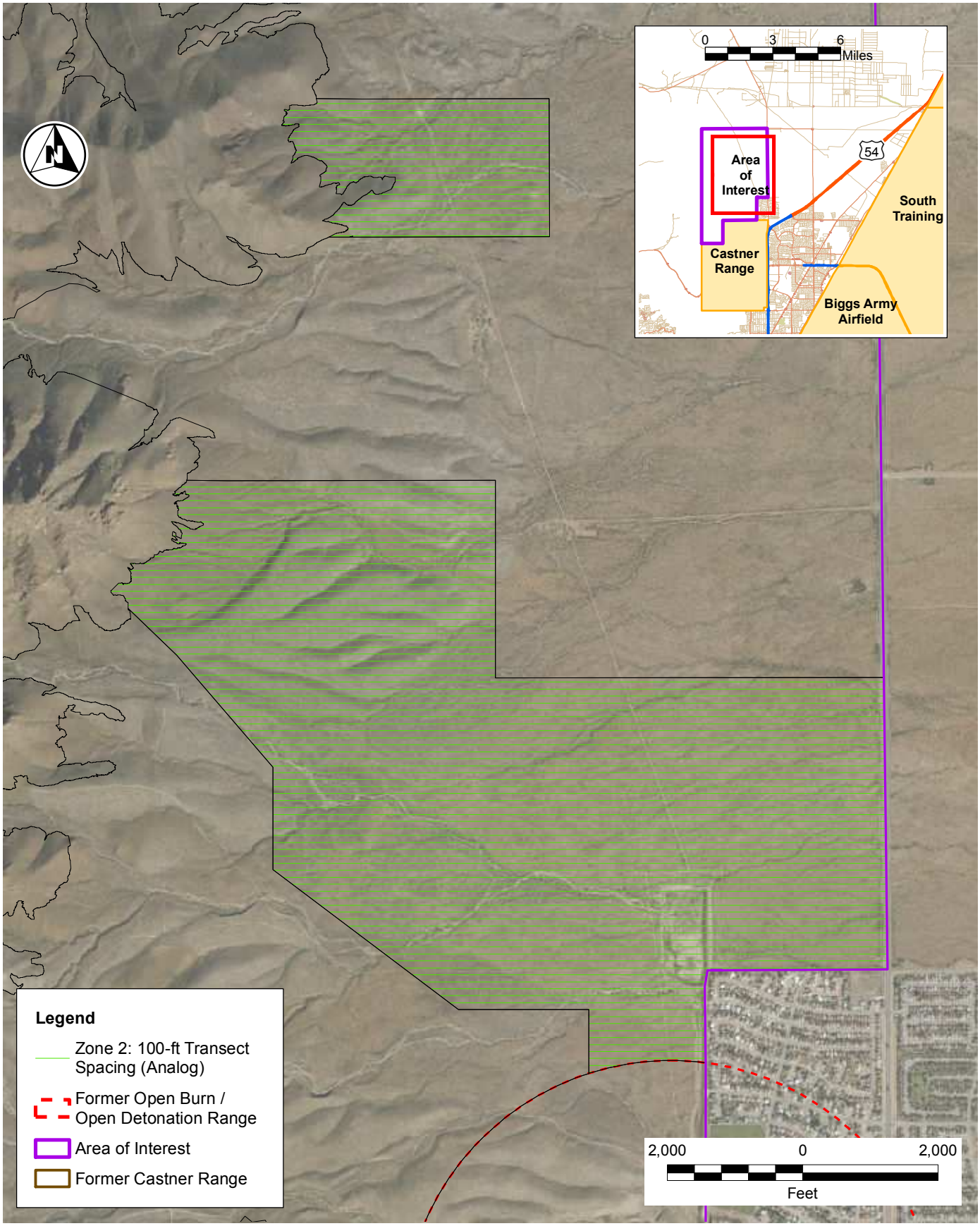
G:\ArcGIS\USACE\Fort_Bliss\KEMRON\QAPP\Map_Docs\SiteFeatures.mxd 4/13/2017 kcholak, Gilbane



Area of Interest North of Castner Range
USACE - Tulsa District
El Paso, Texas

Figure 2-4
OB/OD Kickout Area
50-foot Transect Investigation Zone
Quality Assurance Project Plan

G:\ArcGIS\USACE\Fort_Bliss\KEMRON\QAPP\Map_Docs\OBODarea.mxd 4/13/2017 kcholak, Gilbane



Area of Interest North of Castner Range
USACE - Tulsa District
El Paso, Texas

Figure 2-5
100-foot Transect Investigation Zone
Quality Assurance Project Plan

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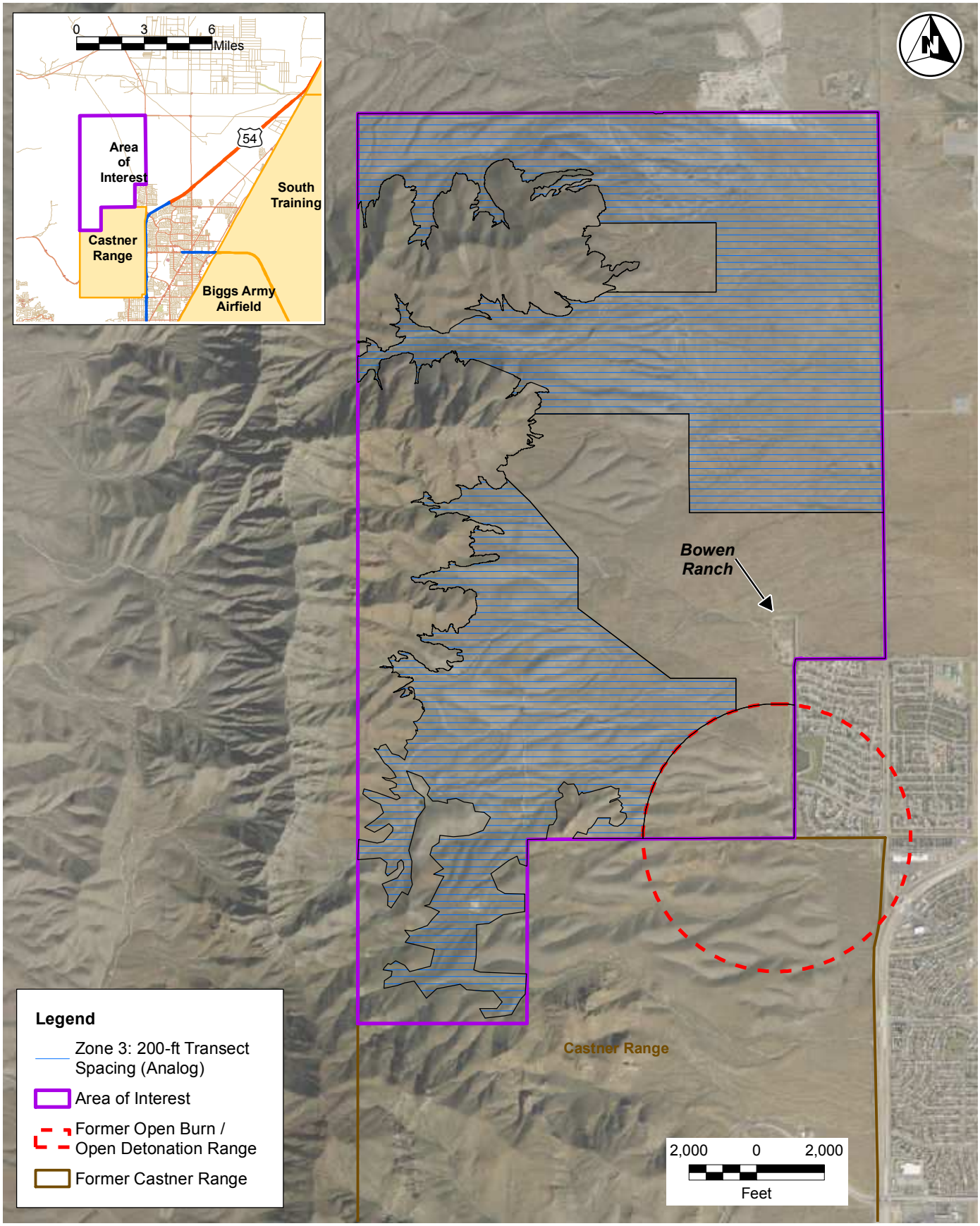

Area of Interest North of Castner Range
USACE - Tulsa District
El Paso, Texas

Figure 2-6
200-foot Transect Investigation Zone
Quality Assurance Project Plan

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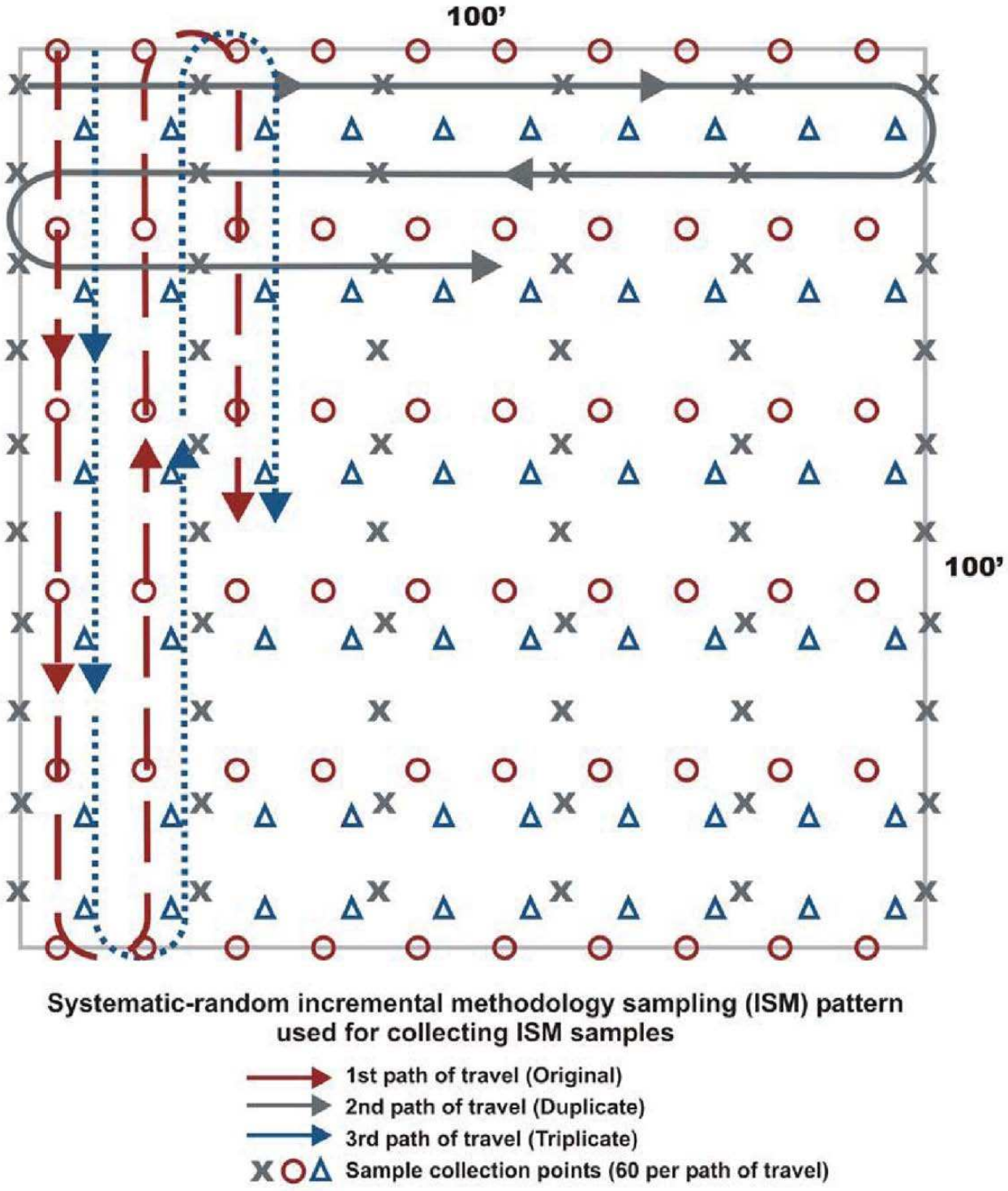
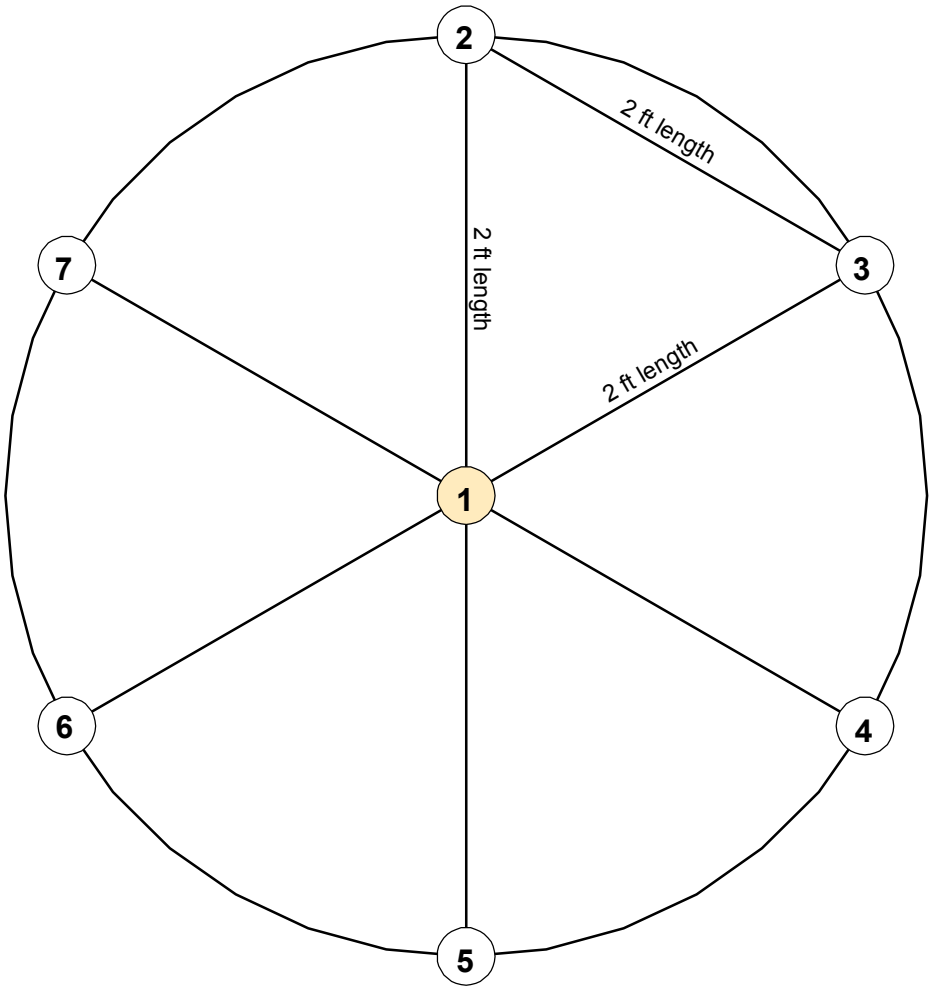


Source:
Interstate Technology Regulatory Council, Incremental Sampling Methodology, February 2012, Figure 5-5.

	Area of Interest North of Castner Range USACE - Tulsa District El Paso, Texas	**Figure 2-7** Example of Systematic-Random IS Pattern Quality Assurance Project Plan

G:\ArcGIS\USACE\Fort_Bliss\KEMRON\QAPP\Map_Docs\SamplingMethodExample.mxd 4/13/2017 kcholak, Gilbane



Legend

Hub Incremental Sample Location

Spoke Incremental Sample Location

0 1 2

Feet

Source:
CRREL, 1996: Assessment of Sampling Error Associated with Collection and Analysis of Soil Samples at Explosive-Contaminated Sites. Figure 2.

	Area of Interest North of Castner Range USACE - Tulsa District El Paso, Texas	**Figure 2-8** Example of Spoke-and-Hub Sampling Scheme Quality Assurance Project Plan

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APPENDIX A

ACCIDENT PREVENTION PLAN AND SITE SAFETY AND HEALTH PLAN